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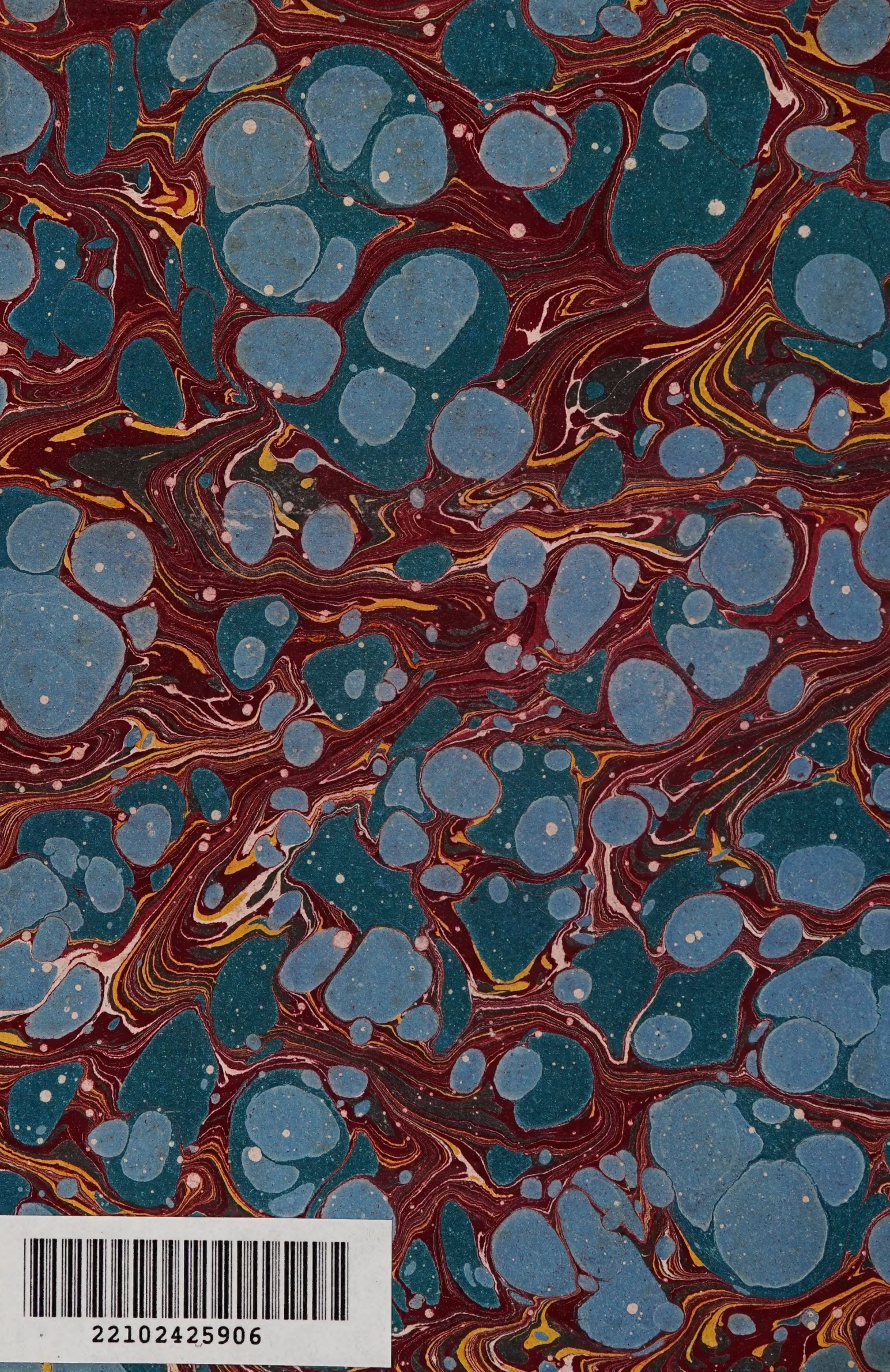
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MEDICINAL PLANTS

BEING

DESCRIPTIONS WITH ORIGINAL FIGURES

OF THE

PRINCIPAL PLANTS EMPLOYED IN MEDICINE

AND AN ACCOUNT OF THE

CHARACTERS, PROPERTIES, AND USES OF THEIR PARTS
AND PRODUCTS OF MEDICINAL VALUE.

BY

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THE PLATES BY DAVID BLAIR, F.L.S.

IN FOUR VOLUMES

VOL. IV (Nos. 228–306)

ARTOCARPACEÆ TO ALGÆ

LONDON

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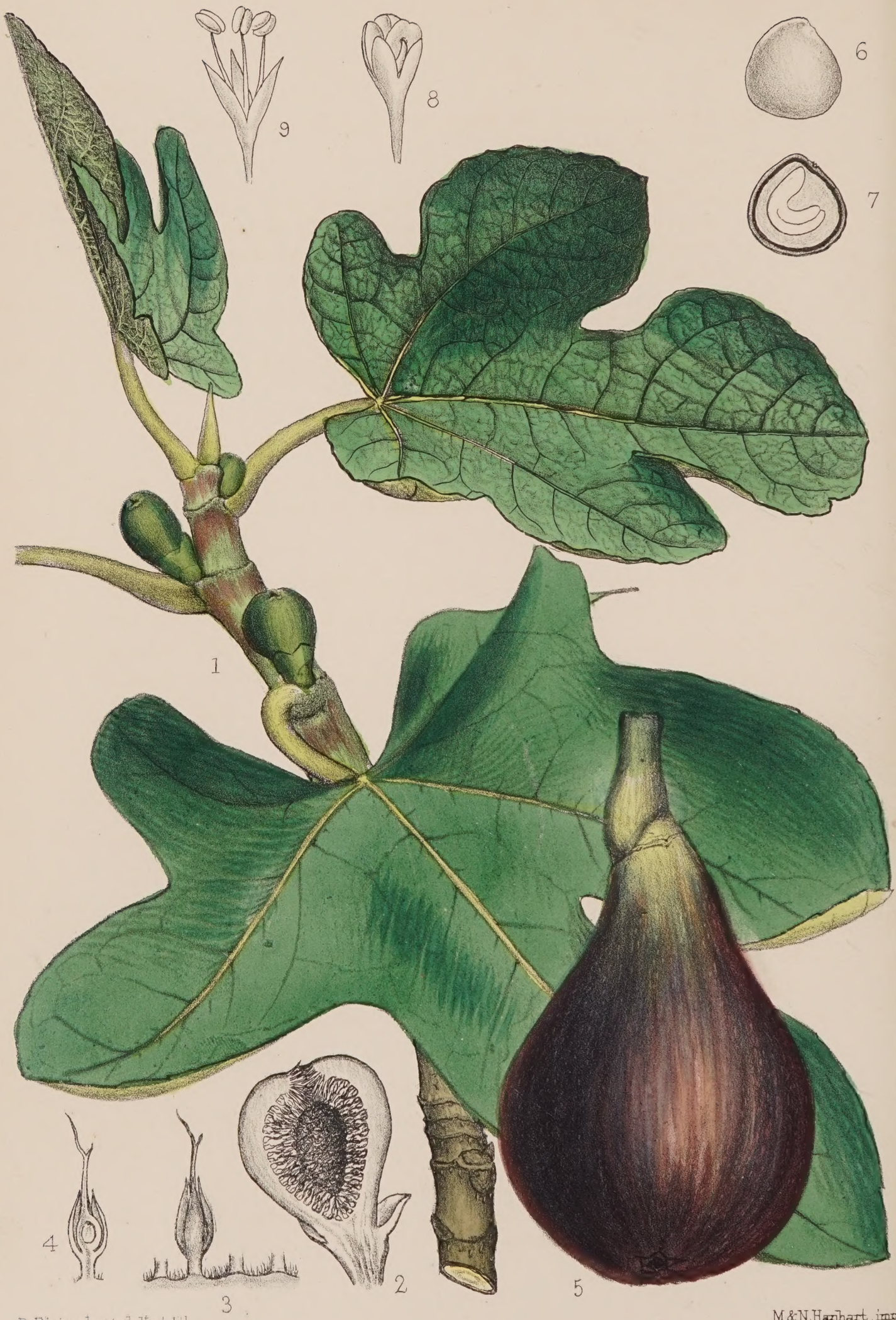

D. Blair ad nat. delt. et lith.

M&N. Hanhart imp.

FICUS CARICA, *Linn.*

N. Ord. ARTOCARPACEÆ. Le Maout & Dec., p. 669; Bureau in DC. Prod., xvi, p. 280.

Tribe *Ficeæ*. Lindl., Veg. K., p. 266.

Genus **Ficus**, *Linn.** A vast genus not as yet fully monographed. Estimated to contain over 600 species (including *Urostigma*, &c.), found in the warmer and tropical parts of both hemispheres.

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228. Ficus Carica,† *Linn., Sp. Plant, ed.* 1, *p.* 1059 (1753).

Fig.

Syn.—Ficus ssp. and Caprificus, *Gasparrini.*

Figures.—Woodv., t. 244; Hayne, ix, t. 13; Steph. & Ch., t. 154; Nees, t. 97; Berg & Sch., t. 19 a; Reichenb., Ic. Fl. Germ., xii, t. 659; Nees, Gen. Fl. Germ., Apet.

Description.—A small, irregularly-branched tree, or large straggling bush; branches numerous, cylindrical, with a smooth reddish or pale grey bark, marked, whilst young, with the scars of the petioles and fallen stipules; the youngest twigs downy. Leaves alternate, deciduous, spreading, on longish, thick, often curved, cylindrical, downy petioles; blade 4 or more inches long, rather rigid, dark green, rough on the upper surface, finely woolly beneath, sub-cordate at the base, usually more or less deeply cut into 3 or 5 palmate, broad, rather blunt lobes, margin more or less irregularly and coarsely dentate-serrate; stipules large, smooth, early deciduous, embracing the whole circumference of the stem and enveloping the young bud like an extinguisher. Flowers unisexual, minute, closely crowded on the inner surface of a large, hollow, externally pear-shaped receptacle, supported at the base by several broad, smooth, scaly bracts, and perforated at the apex by an orifice closed by numerous small scales; these receptacles are axillary and supported on short stalks. Male flowers (not seen) few, found near the mouth of the receptacle, "perianth-segments 3—5, stamens 1—5, generally 3, filaments longer than perianth"

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* *Ficus*, the Latin classical name; in Greek, *συκῆ* or *συκέα*.

† *Carica*, used by the Latin authors for a dried fig; from Caria in Asia Minor, where they were produced.

and inserted at its base. Female flowers occupying the whole, or all but the uppermost part of the receptacle, shortly stalked, perianth very delicate and transparent, deeply cut into 3—5 acute segments; ovary superior, hyaline, 1-celled (rarely 2-celled ?), with a single ovule, style lateral, tapering, much exceeding the perianth and cut into two tapering, usually unequal, stigmas. "Fruit" varying in size to nearly 3 inches long, smooth, yellowish stained with purple, shining, consisting of the pear-shaped receptacle, which has become enlarged, soft, and fleshy, with very numerous minute seed-like nuts (true fruit) crowded over its inner surface, surrounded by the remains of the perianths. Nut 1-celled, pericarp yellow, brittle; seed solitary, suspended, embryo strongly curved lying in a fleshy endosperm.

Habitat.—The Fig tree is native in Syria and some adjacent parts of Asia Minor, extending, in a wild state, perhaps to the north-west confines of India, but, as in the case of universally cultivated plants generally, it is not easy to distinguish the truly wild area. It was very early introduced into the Mediterranean countries of Europe and spread with civilisation over the whole of that continent; it is now found in cultivation in all the temperate and warmer countries of both hemispheres. It ripens its fruit well in England in warm seasons. The form of the leaves is very variable, some trees having them cordate-ovate, or faintly three-lobed; whilst, on the other hand, there are forms with small, deeply-cut, sub-pinnatifid leaves; the size and amount of hairiness also varies considerably. The fruit is sometimes green or white, even when fully ripe. On the varieties of the wild and cultivated fig, reference must be made to Gasparrini's papers quoted below, where they are considered as several species under two genera (*Ficus* and *Caprificus*). It is remarkable that the nuts in many kinds of fig are found to be empty (no embryo being developed), although the "fruit" has thoroughly ripened. The male flowers are rarely found, and, it is said, only in those receptacles which are produced early in the lowest axils.

Gasparrini, Nova Genera (1844), and Ricerche sulla natura del Caprifico (1845); Parlatore, Fl. Ital.; Brandis, Forest Fl. Ind., p. 418; Lindl., Fl. Med., p. 487.

Official Part and Name.—Ficus; the dried fruit (B. P.). The dried fruit (*Ficus*) (I. P.). The dried fruit (U. S. P.).

General Characters and Commerce.—The fruit of the fig is called a *syconus*. A fig consists of a fleshy, hollow, pear-shaped receptacle, provided with a small orifice at its apex, and bearing upon its inner surface numerous small seed-like fruits, termed *achenia*. In the unripe state the receptacle is green and tough, and contains an acrid, somewhat bitter, milky juice; but as it ripens, the receptacle enlarges, becomes softer and more juicy, the acrid milky sap is replaced by a saccharine fluid, and it assumes commonly a purple hue externally, although sometimes a brown or yellow colour, or even remains green.

On a small scale and in favorable climates figs may be dried on the tree, but for commercial purposes they are always gathered and dried either in ovens, or more commonly by exposure to the sun. When dried, they are either rendered pliant by squeezing and kneading, and are then packed by pressing into drums and boxes, in which state they are called *pulled figs;* or they are packed in the state in which they are left after having been dried, when they are termed *natural.*

The largest and best figs come from Smyrna, and are known as *Smyrna* or *Turkey Figs;* smaller and less pulpy figs are likewise imported under the name of *Greek Figs.* The best Smyrna figs are also termed "Eleme Figs." The total imports of figs of all kinds into this country average about 150,000 cwt. annually, representing a money value of about £240,000. Of these about 100,000 cwt. come from Asiatic Turkey, and the remainder from Spain, Portugal, and other countries.

The official Smyrna figs are of an irregular compressed form; soft, tough, more or less translucent, of a brownish or yellowish colour externally, and covered, in cool weather, with a saccharine efflorescence. They have an agreeable, peculiar, fruity smell; and a very pleasant sweet taste.

Composition.—The principal constituent of figs is *grape sugar,* which forms from 60 to 70 per cent. of the dried fruit. It is this sugar which constitutes the efflorescence seen on figs in cool

weather. Figs also contain a small quantity of *gum, fatty matter,* and some other unimportant substances.

Medical Properties and Uses.—Figs are regarded as nutritive, emollient, demulcent, and laxative. They are, however, rarely employed medicinally; but persons subject to habitual constipation sometimes find them useful as an article of diet. Roasted or boiled, and split open, they are occasionally used as a suppurative poultice in gum-boils.

In countries where they are plentiful figs are taken as food, and are regarded as agreeable and wholesome; but in this country they are chiefly employed as a dessert.

Isaiah xxxviii, 21; 1 Sam. xxv, 18; 1 Chron. xii, 40.

Per. Mat. Med., vol. ii, pt. 1, p. 379; Pharmacographia, p. 488; U. S. Disp., by W. & B., p. 407.

DESCRIPTION OF PLATE.

Drawn from a tree in the Royal Botanic Society's Garden, Regent's Park; the male flowers added from Nees, the embryo from Berg and Schmidt.

1. A flowering branch.
2. Section of the inflorescence.
3. A female flower.
4. Section of the same.
5. Ripe "fruit."
6. A nut.
7. Section of the same.
8, 9. Male flowers.

(2–4, 8, 9 enlarged; 6, 7 greatly magnified.

D.Blair F.L.S. ad nat. del. et lith.

MORUS NIGRA, *Linn.*

M & N. Hanhart imp

N. Ord. ARTOCARPACEÆ.

Tribe *Morea.*

Genus **Morus,*** *Linn.* Baill., Hist., vi, p. 190. Species about 6 or 7, natives of Asia and N. America.

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229. Morus nigra, *Linn., Sp. Plant., ed.* 1, *p.* 986 (1753).

Mulberry.

Figures.—Woodville, t. 243; Steph. & Ch., i, t. 39; Hayne, xiii, t. 16; Nees, t. 100; Reich., Ic. Fl. Germ., xii, t. 658; Nees, Gen. Fl. Germ., Apet.

Description.—A small tree, reaching about 30 feet high at the most, with a short trunk and a round bushy head; bark very rough, greyish brown, young twigs pubescent. Leaves alternate, stalked, spreading, with long, hairy, pale brown, caducous stipules, petiole short, cylindrical, pubescent, blade 3—5 inches long, broadly ovate, with a cordate base, subacute, somewhat attenuate at the apex, deeply crenato-serrate, rather stiff, full green and roughish on the upper surface, pale and finely tomentose beneath. Flowers small, unisexual, monœcious, sessile, arranged in short spikes or catkins coming off solitarily from the side of the leaf-axils, the male catkins 1—2 inches long, rather lax, cylindrical, the female much shorter $\frac{1}{4}$—$\frac{3}{4}$ inch, dense, ovoid. Male flowers:—perianth very deeply 4-partite, with oval-oblong, obtuse, concave, hairy segments imbricate in bud; stamens 4, opposite the perianth-segments, inserted at their base, and slightly exceeding them in length, anthers ovate, dorsifixed, 2-celled; pistil rudimentary. Female flowers:—perianth-leaves 4, imbricate in pairs, broadly oval or roundish, obtuse, the outer pair the larger, erect, persistent, downy; stamens none; ovary as long as the perianth-leaves, oval, compressed, 1-celled, with a single pendulous ovule, styles 2, short, filiform. "Fruit" consisting of the whole female inflorescence, about 1 inch long, broadly oblong, cylindrical,

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* *Morus,* in Greek μόρον, the classical name for the tree; probably of Celtic origin.

blunt, lobular, at first red, then passing through purple to almost black, shining, readily falling, principally composed of the persistent perianth-leaves which have become much enlarged and turgid with juice, and are ruptured by a slight touch; true fruit very small, enclosed in the juicy perianth-leaves, and with difficulty separated from them, pericarp membranous, very thin, turgid with juice, afterwards dry. Seed solitary, pendulous, oval, compressed, smooth, testa brittle, embryo strongly curved or doubled in the fleshy endosperm.

Habitat.—The mulberry was known to the ancients, and cultivated by the Greeks and Romans. It is believed to be native to Persia, the Caucasus and Armenia, and to have spread westwards in early times. By the 9th and 10th centuries it was in cultivation in Northern Europe, and probably reached England at no long time after. It grows very well here, and is a favourite fruit tree in old gardens about London. It flowers in June, and the fruit is ripe in September.

In Italy and Sicily, and in Greece, the tree occurs apparently wild, but is probably the result of very ancient cultivation. Up to the 15th century it was grown throughout Italy for the rearing of silkworms, but at that period another species, *M. alba*, Linn., a native originally of North India and China, was introduced and superseded *M. nigra* throughout the country. At the present day *M. alba* is the only species grown for the purpose, exhibiting a great number of varieties.

There is a curious form of the mulberry with a deeply lobed or digitate leaf, which is not unfrequently found on the same tree with ordinary leaves.

Bureau, in DC. Prod., xvii, p. 238; Parlatore, Fl. Ital., x,p. 176; Loudon, Arb. & Frutic. Brit., iii, p. 1343; Seringe, Descr. & Cult. de Mûriers (1855); Lindl., Fl. Med., p. 300.

Official Part and Name.—Mori Succus; the juice of the ripe fruit (B. P.). The juice of the ripe fruit (I. P.). Mulberry juice is not official in the Pharmacopœia of the United States.

General Characters and Composition.—The ripe fruits of this well-known tree, which are commonly termed mulberries, have a

dark purple, almost black, colour, a faint odour, and a refreshing, acidulous, saccharine taste. They are very juicy, and this juice, which has a dark violet colour, and a similar taste and odour to the fruit, is the only official part of the plant.

Mulberries have been analysed by H. Van Hees, who ascertained their chief constituents to be *sugar* and *free acid*, supposed to be *malic*, although probably in part *tartaric*. The other constituents found were *albuminous matter, pectin, fat, gum, salts, cellulin* and *insoluble matters*, and *water*. Compared with other edible fruits, mulberries are remarkable for the large proportion of sugar they contain, being only exceeded in this respect by the fig, grape, and cherry. Thus figs yield the largest amount of sugar of any fruit, grapes from 10·6 to 19 per cent., cherries 10·79, mulberries 9·19, currants 6·1, strawberries 5·7, and raspberries 4 per cent.

Medical Properties and Uses.—In medicine mulberry juice is principally used in the preparation of the official syrup of mulberries, which possesses refrigerant and slightly laxative properties. It is chiefly employed as a colouring and flavouring agent, and as a laxative for infants. The juice, which is refrigerant, may be used as a drink in febrile diseases. The fruits may also be employed for a like purpose, but should be avoided when there is a tendency to diarrhœa.

Other Uses of the Plant.—The *fruit* is well known as an esteemed dessert fruit. In Greece it is submitted to fermentation for the purpose of affording an intoxicating beverage. The *leaves* of this species, but more especially those of *Morus alba*, are in common use as food for silkworms ; and the *bark of the root*, which has a somewhat acrid and bitter taste, possesses cathartic and anthelmintic properties. For the latter purpose, two drachms of the bark may be infused in eight ounces of boiling water for an hour, and the infusion, when strained, taken as a dose. It is said to be especially useful in cases of tapeworm.

Per. Mat. Med., vol. ii, pt. 1, p. 378; Pharmacographia, p. 489; U. S. Disp., by W. & B., p. 563; Bentl., Man. Bot., p. 620.

DESCRIPTION OF PLATE.

Drawn from a specimen in the garden of the Apothecaries' Company, Chelsea.

1. Branchlet with foliage and fruit.
2. A male catkin.
3. A male flower.
4. Section of the same.
5. The same, expanded.
6. A female catkin.
7, 8. Female flowers.
9. Vertical section of the same.
10, 11. Perianth-leaves of female flower.
12. Cross section of a mulberry.
13. A single altered flower isolated.
14, 15. Fruit.
16, 17. Seed.
18. Vertical; and—19. Transverse section of the same.

(3–5, 8–11, 15, 17–19 enlarged.)

D.Blair F.L.S. ad nat. del. et lith.

HUMULUS LUPULUS, *Linn.*

M & N. Hanhart imp

N. Ord. CANNABINEÆ. Lindl., Veg. K., p. 265; Le Maout and Dec., p. 674.

Genus Humulus,* *Linn.* Baill., Hist. Pl., vi, p. 162. Species 2 or 3, natives of temperate parts of the northern hemisphere in the Old World.

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230. Humulus Lupulus,† *Linn., Sp. Plant, ed.* 1, *p.* 1028 (1753).

Hop.

Syn.—H. americanus, *Nutt.*

Figures.—Bigelow, t. 60; Hayne, viii, t. 36; Steph. & Ch., t. 41; Nees, t. 101; Woodville, vol. v; Berg & Sch., t. 27 b; Syme, E. Bot., viii, t. 1284; Reich., Ic. Fl. Germ., xii, t. 656; Nees, Gen. Fl. Germ.; Lindl., Veg. K., fig. 179; Baill., Hist. Pl., figs. 129—136.

Description.—A large herbaceous perennial twiner, with a large, thick, branched rootstock. Stems several, reaching a length of 20 feet or more, closely twining or twisted, slender but very strong and tough, almost woody at the base, cylindrical, striate, very rough with small harsh prickly hairs along the lines. Leaves opposite, with very long scabrous petioles, stipules caulinary, large, the adjacent ones of each opposite pair united to form a single, large, ovate, acute, membranous, interpetiolar stipule at first erect afterwards strongly reflexed; blade 3—4 inches long and equally broad, rather variable in form, usually deeply cordate at base, palmately cut about half-way down into 3 or 5 ovate acute lobes, coarsely serrate, very rough on both surfaces especially on the prominent veins beneath; the upper leaves much smaller, often ovate, not lobed. Flowers numerous, unisexual, diœcious; the male small, on slender pedicles arranged in lax divaricate or slightly drooping axillary panicles, with small acute bracts, the female much smaller, sessile, each one in the axil of a very small, obtuse, pilose, roundish bractlet on its outer side (which is persistent and greatly enlarged in fruit), and arranged in

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* *Humulus*, a name first used by Linnæus, and probably founded on the names of the plant in the languages of northern Europe.

† *Lupulus*, the classical name of the plant; *Lupus salictarius* of Pliny.

pairs in the axil of a larger membranous acute bract, the whole closely placed on a short axis so as to form a small, ovoid, contracted inflorescence at the end of a long axillary peduncle. Male flower :—perianth very deeply cut into 5 oval-oblong acute segments, greenish-yellow, glabrous ; stamens 5, opposite the segments, filaments very short, anthers oblong-linear, apiculate, opening by two terminal slits. Female flower :—perianth monophyllous, very thin and membranous, closely surrounding the ovary, persistent ; ovary ovoid, smooth, 1-celled, with a single pendulous ovule, styles 2, much longer than the ovary, and projecting considerably beyond the larger bracts, subulate, densely hairy, purple. "Fruit" consisting of the whole inflorescence, the bracts of which have become much enlarged and scale-like, whilst the bractlets have so much increased as to equal them in size, the whole forming an oblong-ovoid or sub-globose, cone-like, nodding, catkin (strobile) 1—1½ inches long ; scales ovate or roundish, all very similar in shape, but the original bracts usually more acute and more strongly veined than the bractlets which also have the base sprinkled over on the outer side with minute superficial yellowish glands, all dry and papery, veiny, greenish-yellow or brownish ; true fruit about as large as hempseed, seed-like, borne at the base of the enlarged bractlets, sub-globular, slightly compressed, enveloped in the persistent loose membranous perianth, the lower part of which also is sprinkled with minute, globular-topshaped, shining, yellowish grains or glands (lupulin), pericarp hard, brittle. Seed solitary, pendulous, testa very thin, embryo with long cotyledons, spirally coiled, flat, no endosperm.

Habitat.—The Hop, which has been well called the "Northern Vine," is found in a wild state throughout Europe except the extreme north, and extends eastwards to the Caucasus and through Central Asia to the Altai Mountains. It is also common but doubtfully indigenous in the northern and western United States of America, and has been introduced into Brazil and Australia. In England the hop is a common wild plant climbing over hedges and bushes, especially in the south ; in Scotland it is

not thought to be native. It flowers in July and August, and the fruit is ripe at end of September.

The cultivation of the hop certainly goes back to the eighth and ninth centuries in northern and western Europe, but was never practised by the Greeks or Romans. In England, however, the plant does not appear to have been at all generally used before the beginning of the seventeenth century, but rapidly grew in estimation, and, at the present time, this country produces the largest amount of any European State; the principal area is the County of Kent and the adjacent parts of Sussex and Surrey, but hops are also grown in Hampshire and in Worcestershire and Herefordshire. Several varieties are recognised by cultivators, depending on the shape and colour of the ripe cones. Monœcious plants are occasionally met with. Some English botanists have considered the plant to be an introduction to this country, but there does not appear to be any good reason for the supposition. Boswell Syme indeed states that the seed rarely ripens here, but we have frequently found it so in the south of England.

Good figures of the Lupuline grains will be found in Berg's 'Anatomischer Atlas,' t. 49.

Syme, E. Bot., viii, p. 133; Hook. f., Stud. Fl., p. 333; Watson, Comp. Cyb. Brit., p. 310; Gren. & Godr., Fl. France, iii, p. 112; Ledebour, Fl. Ross., iii, p. 635; A. Gray, Man. Bot. N. U. States, p. 446; DC. Prod., xvi, 1, p. 29; Lindl., Fl. Med., p. 296; DC. Géogr. Bot., p. 857; Flück. & Hanb., Pharmacogr., p. 495.

Official Parts and Names.—Lupulus; the dried strobiles of the female plant (B. P.). The dried strobiles of the female plant (I. P.). 1. Humulus; the strobiles: 2. Lupulina; the yellow powder separated from the strobiles (U. S. P.). The common name by which the strobiles are designated in the British Pharmacopœia and the Pharmacopœia of India is *Hop*, and in the Pharmacopœia of the United States as *Hops*.

1. Lupulus or Humulus.—*Collection and Preparation.*—In the British Pharmacopœia the dried strobiles or fruits are directed to be obtained from plants cultivated in England. In the Pharma-

copœia of India, and the Pharmacopœia of the United States, no special source is indicated. In England the *gathering* or *picking* of the strobiles takes place in September; the hops are then dried in kilns; and finally packed in hempen sacks, called *bags* or *pockets*. By keeping hops lose their fresh appearance, become darker coloured, and acquire an unpleasant odour from the formation of a little valerianic acid; hence in order to prevent or retard these changes they are frequently exposed to the fumes of burning sulphur. Hops when freshly prepared in this way smell of sulphurous acid, and their use in this state should be carefully avoided in medicine; but it is said that by keeping the injurious character of the acid is soon lost. Hops thus treated have also been strongly objected to by brewers, but, according to Liebig, without any real foundation.

General Characters and Composition.—The strobiles as found in commerce are more or less compressed and broken up. When fresh they have a pale greenish-yellow colour; an agreeable, peculiar, somewhat aromatic and narcotic odour; and a bitter, aromatic, pungent, and feebly astringent taste. Their odour and taste are essentially due to the lupulinic glands, which are described below under the head of *lupulina;* and it is in these that the virtues of hops almost entirely reside. When handled, or more especially when rubbed between the fingers, they have a sticky feel, and their odour becomes more evident. But by keeping, as already noticed, the odour of hops becomes less agreeable, or even unpleasant, from the formation of a little valerianic acid. At the same time they also lose their greenish-yellow colour and fresh appearance, and acquire a brown tint, and frequently a spotted appearance; and finally become weaker and of inferior value.

The principal constituents of hops are *volatile oil, bitter principle, wax,* and *resins.* These substances appear to be confined to the lupulinic glands, or if they exist in the scales at all, they are in far less proportion. The principal constituent of the scales or bracts is a kind of *tannic acid;* it is found in the proportion of from 3 to 5 per cent., and has been named *lupulo-tannic acid.* The experiments of Griessmayer show that hops also contain a minute

quantity of *trimethylamine*, and a liquid volatile alkaloid, named by him *lupuline*, and which is said to have the odour of *conia*. The medicinal properties of hops essentially reside in the volatile oil and bitter principle, for which reason the lupulinic glands are the most active part of this drug, but they want the astringency of the scales. The nature of the volatile oil and other special constituents of the lupulinic glands are described below under *lupulina*.

Medical Properties and Uses.—Hops possess tonic and slightly narcotic properties; they are also somewhat astringent. The narcotic property appears to be derived from the volatile oil, hence a pillow of hops is sometimes useful to prevent restlessness, and induce sleep, in nervous and other affections; but when so employed it is advisable to moisten the hops previously in spirit, in order to prevent the rustling noise which they otherwise produce. Fomentations and poultices of hops have been also found to give relief in painful swellings and tumours; and an ointment made by mixing powdered hops with lard has been recommended as an anodyne application in cancerous tumours.

Internally, hops are usually administered in the form of infusion, extract, or tincture; and have been found more especially useful in cases of atonic dyspepsia. They have been also given with success in the nervous tremors, wakefulness, and delirium of drunkards; for diminishing the tendency to nocturnal emissions, and in allaying chordee; in nervous affections attended with sleeplessness; in hysteria, intermittent fevers, rheumatism, gouty spasm of the stomach, and other diseases; but in this country, except as adjuncts, hops are but little used in medicine.

The principal consumption of hops, is in the manufacture of beer and ale, to which they communicate a pleasant bitter and aromatic flavour, and also tonic properties; hence bitter ale taken with meals, is frequently a useful remedy in atonic dyspepsia. Hops when added to beer and ale also check the acetous fermentation.

2. Lupulina.—This substance is only official in the Pharmacopœia of the United States, although, as already stated, the

medicinal properties of hops essentially reside in it. It is commonly known under the name of *lupulin* or *lupuline;* but both this name and that of *lupulina* are objectionable, as they should be reserved for the *bitter principle* of hops. It is more correctly known by the name of *lupulinic glands.*

Collection and Preservation.—Lupulinic glands are principally found at the base of the scales of the hop strobiles; but they are also scattered to some extent over the whole surface of these fruits. They may be readily obtained either by rubbing or threshing the dried strobiles, or by first stripping off the scales and shaking or rubbing them; and then separating the powder which has been detached by a sieve. This powder should afterwards be washed by decantation, by which any sand or earth which is always mixed with it to some extent is removed; and, finally, it should be carefully dried, and preserved for use in well-stoppered bottles. The dried strobiles yield from about 8 to 16 per cent. of these glands.

General Characters and Composition.—When viewed in substance by the naked eye, the lupulinic glands appear in the form of a brownish-yellow, granular powder. This powder has the agreeable odour and the bitter taste of hops; it burns readily, like lycopodium, when thrown into the air and ignited; and is readily wetted by alcohol or ether, and also gradually by water. When examined by the microscope the true nature of this powder is manifest, for it is then seen to be composed of minute, somewhat globular-topshaped, shining, yellowish glands, which have been thus described by Stoddart: "From $\frac{1}{260}$ to $\frac{1}{140}$ of an inch in diameter, shaped like flattened, subovate, little saucers, and covered over by cell markings. They are attached by a short pedicel. As they get older the central portion expands, and instead of the former concave shape, swell out and become convex." The stalk is not perceptible in the detached gland as found in commerce. The recent gland is filled with a dark brown or yellowish liquid; but in the dried gland of commerce this liquid is contracted, and forms a mass in its centre.

The composition of the lupulinic glands has been already

referred to in speaking of the constituents of the strobiles. Their virtues appear to reside in the volatile oil and bitter principle. Both these substances are taken up by alcohol; but by boiling the glands in water, although their bitterness is then extracted, their aroma is more or less driven off. The *volatile oil* may be readily obtained by distilling hops with water; the yield varying from 1 to 2 per cent. The odour of hops is due to this volatile oil. It has a greenish or reddish-brown colour, according as it is distilled from the fresh or old strobiles. It has no rotatory power, is neutral to litmus paper, and when exposed to the air it soon resinifies; hence the lupulinic glands, which owe much of their medicinal value to this oil, are preferable in a fresh state, and should always be preserved excluded from the air in closely stoppered bottles. This oil, as first noticed by Personne, always contains a small proportion of *valerol*, which ultimately passes into *valerianic acid;* in fact, according to Méhu, lupulinic glands contain from 0·1 to 0·17 per cent of this acid. The formation of valerianic acid in hops by keeping, has already been noticed, in speaking of the collection and preparation of the strobiles. The *bitter principle* has been variously named by chemists *lupulin, lupuline, lupulite,* and *humulin.* It was first noticed by Payen, but does not appear to have been obtained in a pure state till 1863, when it was isolated by Lermer, who called it the *bitter acid of hops.* It is contained in but minute proportion in the lupulinic glands. It crystallises in large rhombic prisms, and has an extremely bitter taste. It is probably the tonic principle of the hops. The recent experiments of Etti also show, that hops contain a *crystallised white,* and an *amorphous brown resin,* to which the bitter principle adheres.

Medical Properties and Uses.—For medicinal use lupulina possesses all the important properties of the strobiles, and may be with advantage, in most cases, substituted for them, both for external use, and internal administration; in this country, however, it is but very rarely prescribed. Its effects are stated to be especially manifest in certain irritable conditions of the genito-urinary organs, as in irritable bladder, gonorrhœa, spermatorrhœa, and chordee.

Per. Mat. Med., vol. ii, pt. 1, p. 375; Per. Mat. Med., by B. & R., p. 508; Pharmacographia, pp. 497–500; U. S. Disp., by W. & B., p. 460; Thomson, Lond. Disp., by Garrod, p. 400; Chem. Gaz., April 1, 1856, from Comptes Rendus, and July 15, 1853; Griessmayer, in Amer. Journ. Pharm., Aug., 1874, p. 360; Stoddart, in Pharm. Journ., ser. 3, vol. i, p. 986; Ives, in Silliman's Journ of Sci., vol. ii (1820), p. 302; Trécul, Annales des Sciences Nat. Bot., vol. i (1854), p. 299; Pharm. Journ., ser. 3, vol. ix, p. 350; Duckworth, in Pharm. Journ., ser. 2, vol. x, p. 246.

DESCRIPTION OF PLATE.

Drawn from a specimen cultivated in Kew Gardens.

1. A branchlet of a female plant with ripe catkins.
2. A fruit with its enlarged bractlet.
3. A fruit enveloped in the persistent perianth.
4. The same with the perianth removed.
5. Vertical—and 6. Transverse section of fruit.
7. Portion of panicle of male flowers.
8. A single flower.
9. Two female flowers with their bractlets and bract.
10. Bractlets of the same.
11. Vertical section of the ovary.

(3—7, 9—11 enlarged.)

D.Blair F.L.S. ad nat.del.et lith.

M & N.Hanhart imp.

CANNABIS SATIVA, *Linn.*

N. Ord. CANNABINEÆ.

Genus Cannabis,* *Linn.* Baill., Hist. Pl., vi, p. 215. There is but a single species.

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231. Cannabis sativa, *Linn., Sp. Plant., ed.* 1, *p.* 1027 (1753).

Hemp. Indian Hemp. Bhang, Ganja (Hindustani).

Syn.—C. indica, *Lam.* C. chinensis, *Del.*

Figures.—Hayne, viii, t. 35; Nees, t. 102; Berg & Sch., t. 19 b; Syme, E. Bot., viii, t. 1283; Reichenb., Ic. Fl. Germ., xii, t. 655; Nees, Gen. Fl. Germ.; Baill., Hist. Pl., vi, figs. 137—145; Rheede, Hort. Malab., x, t. 60, 61.

Description.—Annual. Stem from 3—10 feet or even more in height, erect, often slightly woody at the base, simple or slightly branched, slender, striate, slightly rough with a very close short and fine tomentum, greyish-green. Leaves numerous, alternate or opposite, spreading, on long slender scabrous petioles with linear acute stipules at the base, palmate, leaflets 5—7, or only 3 in the upper leaves, the middle one longest, sessile, linear-lanceolate, acute or attenuate at both ends, strongly and sharply serrate, finely scabrous and dark green above, pale and very finely downy beneath. Flowers unisexual, diœcious, small; male numerous, shortly stalked, irregularly arranged on the branches of lax drooping panicles from the axils of the leaves and summit of the stem, female fewer, sessile, each with a small bract, crowded in erect, simple, short spikes leafy below, from the axils of the leaves. Male flower:—Perianth very deeply divided into 5 almost separate, spreading or reflexed, oblong, subacute, nearly equal, downy, pale yellowish segments, imbricate in the ovoid acuminate bud; stamens 5, opposite the segments, filaments slender, very short, anthers large, pendulous, 2-celled. Female flower:—Perianth a single cordate-ovate, hirsute, glandular, 5-veined leaf, sheathing round and entirely enclosing the ovary; ovary ovoid, smooth, one-celled, with a single pendulous

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* *Cannabis, κάνναβις,* the classical name; of oriental origin.

ovule, style very short or none, stigmas 2, filiform, long, protruding far beyond the perianth, hairy. Fruit small, about $\frac{1}{12}$ inch long, enclosed in the persistent spathe-like perianth, ovoid-compressed, pointed, pericarp indehiscent but easily separable into 2 valves on pressure, smooth, pale brownish-grey. Seed completely filling the fruit, embryo strongly curved or doubled on itself, peripheric ; endosperm scanty, oleaginous.

Habitat.—The Hemp is a native of the temperate parts of Asia near the Caspian, Southern Siberia, the Kirghiz desert, and Persia ; also probably of Northern India, Kashmir, and the Himalayas; in the latter country, as also in China, it was at all events of very ancient cultivation. It is said to have been introduced into Italy in the Roman period, and has gradually spread into all temperate and warm countries of both the old and new worlds. It does not appear to have been known to the ancient Egyptians. The cultivation of Hemp is now chiefly carried on in Central and Southern Russia. In England the plant is not unfrequently met with as a casual weed in gardens and waste ground near houses, being very frequently the offspring of seed from the cleanings of birdcages.

The Indian Hemp differs in no respect from the common plant unless in being somewhat taller and having the leaves more constantly alternate. The width of the leaflets varies considerably ; as a rule they are somewhat narrower in the male than the female plant ; the latter is also usually rather taller and darker in colour.

In Algeria the Hemp is cultivated under the name of *Kif* or *Tekrouri ;* the form there grown has a somewhat different habit, and smaller, darker, mottled fruit.

Syme, E. Bot., viii, p. 131; Ledebour, Fl. Ross., iii, p. 634; Gren. & Godr., Fl. France, iii, p. 112; Roxb., Fl. Ind., iii, p. 772; A. DC., Geogr. Botan., p. 833; Christison, in Ann. & Mag. Nat. Hist., v (1850), p. 483; Dukerley, in Bull. Bot. Soc. France, xiii, p. 401; Lindl., Fl. Medica, p. 299; Flück. & Hanb., Pharmacogr., p. 481.

Official Part and Names.—Cannabis Indica ; the dried flowering tops of the female plants grown in India, and from which the

resin has not been removed (B. P.). The dried flowering tops of the female plant grown in India, from which the resin has not been removed (*Indian Hemp, Gunjah,* Hind. (I. P.) 1. CANNABIS INDICA; the flowering tops of the female plant of Cannabis sativa, variety Indica: 2. CANNABIS AMERICANA; the flowering tops of Cannabis sativa, cultivated in North America (U. S. P.).

Production and Forms.—The whole of this drug which is employed in European medicine is derived from India, where it is grown in many localities, but principally in the districts of Bogra and Rájsháhi, to the north of Calcutta. Indian Hemp is alone official in the British Pharmacopœia and the Pharmacopœia of India; but in the last Pharmacopœia of the United States, both Indian Hemp and American Hemp, which is obtained from plants cultivated in North America, are official. There are several forms and preparations of Indian Hemp, but the only one which is official is that which is known in India under the Hindustani name of *Gunjah* or *Ganja.* By the London drug-brokers it is termed *Guaza.*

GUNJAH OR GANJA.—*General Characters and Composition.*—This, which is the principal Indian form of the plant, consists of the dried tops after flowering, and from which the resin has not been removed. As usually imported, the samples are made up of more or less aggregated small masses, each of which is from about one and a half to two inches and a half in length, and consisting of the tops of one or more alternate branches, bearing the remains of the flowers and smaller leaves with a few ripe fruits, and the whole pressed together by adhesive resinous matter. Other samples are composed of straight, stiff, woody stems, several inches long, and bearing above the branched flowering stalks.

Gunjah is rough to the touch, very brittle, of brownish-green or dusky-green colour, and with scarcely any taste, but with a faint, peculiar, narcotic, not unpleasant odour. Powell says that when the leaves have been picked off from the plant, to constitute the other principal form of hemp known in India, called

bhang, little shoots arise from the stem, and that these when picked off and dried, form *gunjah*.

The most important constituents of Indian Hemp are *resin* and *volatile oil*. The resin, which has been termed *cannabin*, is described by T. and H. Smith, as brown in mass, but of a fawn colour in thin layers, and burning with a bright white flame and leaving no ash. It is soluble in both alcohol and ether. The effects of Indian Hemp are commonly regarded as mainly, if not entirely, due to this constituent. Gunjah yielded Messrs. Smith from 6 to 7 per cent. of resin. Gastinell, who has recently examined the plant cultivated in Egypt, also describes its active constituent as a resin, which he says exists in the proportion of about 3 per cent., and which he has named *hashishin*.

The volatile oil exists in but very small proportion, thus according to Bohlig, to the extent of only 0·3 per cent. in the fresh herb after flowering. It is lighter than water, and is described by Personne as of an amber colour, and with the oppressive odour of the hemp plant. The latter chemist has resolved it into two bodies, one a colourless liquid which he has termed *cannabene*, and the other a solid hydride of this (*hydride of cannabene*). The volatile oil is regarded by Personne as the sole active principle of Indian Hemp ; but although its vapour is stated to produce when inhaled a peculiar sensation of shuddering, with motor excitement, followed by prostration and syncope, further evidence is required before we can speak positively on its action. Dr. Preobraschersky has recently announced the discovery of a volatile alkaloid in the tops, &c., of Indian Hemp, which he states is similar in its reactions to *nicotia* or *nicotine*, the active principle of tobacco ; hence, should its presence be confirmed, it must be, at least, one of the active constituents of the drug.

Medical Properties and Uses.—Garrod says "Indian Hemp produces a peculiar kind of intoxication, attended with exhilaration of the spirits and hallucinations, said to be generally of a pleasing kind. These are followed by narcotic effects, sleep and stupor. In its anodyne and soporific action it resembles opium, but its after effects are considered less unpleasant ; it does

not produce constipation nor loss of appetite. Indian hemp possesses antispasmodic and anodyne powers, for which it has been chiefly employed in medicine. It has been administered in the different forms of neuralgia, in spasmodic coughs, as pertussis and asthma, also in tetanus, hydrophobia, and other anomalous spasmodic and painful diseases. Sometimes, but very seldom, it has been used to procure sleep." Christison states that for energy, certainty, and convenience, Indian hemp is the next anodyne, hypnotic, and antispasmodic to opium, and often equals it. Dr. Clendinning speaks favorably of its use as a nervine stimulant in removing languor and anxiety, and raising the pulse and spirits; and Dr. Conolly thinks it may be useful in some chronic forms of mania. As a medicine, however, it is quite clear that Indian hemp has not fulfilled the expectations formed of it on its first introduction into this country; it is therefore but little employed at the present time.

In the East, Gunjah and the other forms and preparations of Indian hemp as described below, are enormously used by Hindoos and Mahomedans, either for smoking with or without tobacco, or by swallowing them in combination with other substances, or by infusion in water, &c.

Other Forms and Preparations of Indian Hemp.—The other principal forms in which Indian hemp is met with in the East are *Bhang, Churrus, Hashish,* and numerous electuaries, pastes, &c., in which butter or some other oily substance is the basis of formation, as *majoon* in Calcutta, *mapouchari* at Cairo, and the *dawames* of the Arabs.

1. *Bhang, Sidhee,* or *Subjee.*—This form is very much used in India. It consists of the dried coarsely broken larger leaves of the plant, mixed with a few fruits. It has a dark-green colour, and resembles gunjah in odour and taste. It is largely employed in India for smoking, either with or without tobacco; and as the active ingredient of the sweetmeat called *majun* or *majoon.* An intoxicating drink is also prepared by infusing the coarsely powdered leaves in cold water.

2. *Churrus or Charas.*—This is the resin which spontaneously

exudes in minute drops from the stems, leaves, and tops. It is collected in several ways as follows :—thus O'Shaughnessy states that men in leathern garments brush forcibly through the plants, and the resin which then adheres to them is scraped off. Another way is by rubbing or pressing the tops of the plant in the palms of the hands, and afterwards scraping off the adhering resin. A third method, according to Powell, consists in collecting the dust which arises when masses of dry bhang are stirred about. This resin is necessarily a very impure substance, hence is not used in medicine, but is chiefly consumed by smoking. The best is imported into India from Yorkand.

Gunjah, Bhang, and Churrus, are the principal forms of hemp which are found in India.

3. *Hashish, Haschisch,* or *Hashash.*—This is the Arabic term for Hemp. It is largely employed in Arabia, and consists of the dried tops of the plant which are gathered some time before the seeds are ripe. The word assassin is commonly said to be derived from the Arabic name for hemp.

In Central Asia a preparation of Indian Hemp is found in flat cakes, which is also termed Hashish by the Russians, and *nasha* by the Bucharians. Dr. Preobraschersky, who has recently analysed it, says its important constituents are an *aromatic resin* of tolu-like odour, a *colourless volatile oil,* and a *volatile alkaloid* analogous to nicotia in its reactions.

Other Products and Uses of the Hemp Plant.—This plant produces the valuable fibre known as Hemp. It is found, however, that the hemp plant grown in tropical countries produces less valuable fibres than the plant of colder latitudes, but that the former is far more active as an intoxicating and medicinal agent from secreting a much larger quantity of the narcotic resin. Hemp is principally obtained from Russia; but the best is produced in Italy. Inferior hemp is also derived from the United States and India. Hemp is chiefly used for cordage, sacking, and sail-cloths. In 1873, 1,251,000 cwts. were imported into this country.

The fruits, commonly called *Hemp seeds,* are the achenes of this

plant. Each achene contains a single oily seed. These fruits are demulcent and oleaginous, but appear, at least when ripe, to have no narcotic properties. They are used for feeding birds; and when submitted to pressure, they yield about 25 per cent. of a fixed oil, which is employed as a varnish, and for other purposes.

Per. Mat. Med., vol. ii, pt. 1, p. 367; Per. Mat. Med., by B. & R., p. 504; Pharmacographia, p. 491; U. S. Disp., by W. & B., p. 392; O'Shaughnessy, Bengal Disp., pp. 579—604; Powell, Economic Products of the Punjab, 1868, p. 293; Garr. Mat. Med., p. 361; Cooke, Seven Sisters of Sleep, pp. 212—257; T. & H. Smith, in Pharm. Journ., vol. vi, ser. 1, p. 171; Personne, Journ. de Pharm., vol. xxxi (1857), p. 48; Proc. Amer. Pharm. Assoc., vol. xxii, p. 160; Pharm. Journ., vol. iv, ser. 3, p. 696; Amer. Journ. Pharm., vol. xlix, p. 371, from Ph. Zeitschr. Russl., 1876, pp. 705—714.

DESCRIPTION OF PLATE.

Drawn from specimens grown in Kew Gardens.

1. Upper part of a female plant.
2. A female flower.
3. Perianth unrolled.
4. Ovary.
5. Section of the same.
6. A male panicle.
7. A bud.
8. A male flower.
9. Stamens.
10, 11. Fruit surrounded with the persistent perianth.
12, 13. Fruit.
14. Vertical, and—15. Transverse section of fruit.

(2–5, 7–9, 11, 13–15 enlarged.)

D.Blair F.L.S. ad nat. del. et lith.

M & N. Hanhart imp.

ULMUS CAMPESTRIS, *Linn.*

N. Ord. ULMACEÆ. Lindl., Veg. Kingd., p. 580; Le Maout & Dec., p. 676; Baill., Hist. Pl., vi.

Tribe *Ulmeæ*.

Genus **Ulmus**,* *Linn.* Baill., Hist. Pl., vi, p. 184. Species about 20, natives of temperate regions in the Northern Hemisphere.

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232. Ulmus campestris, *Linn., Sp. Plant., ed.* 1, *p.* 225 (1753).

Elm. Common Elm.

Syn.—U. suberosa, *Ehrh.* U. glabra, *Mill.*

Figures.—Woodville, t. 242; Hayne, iii, t. 15; Steph. & Ch., t. 120; Nees, t. 104; Syme, E. Bot., viii, 1285, 6; Reich., Ic. Fl. Germ., xii, t. 661; Nees, Gen. Fl. Germ.

Description.—A large tree, frequently reaching a height of 100 feet, with a stout erect trunk with very rough brownish-grey bark deeply furrowed longitudinally, and many large branches forming a rather narrow rounded head, with rough brown bark often with thick corky ridges, twigs very numerous, slender, young shoots pubescent, buds small, purple. Leaves alternate, on very short hairy cylindrical petioles; stipules oblong, blunt, membranous, pale brown, quickly deciduous; blade 1½—3 inches long, broadly oval or somewhat obovate, very unequal at the base, acute at the apex, irregularly and rather deeply serrate, the numerous parallel secondary veins running out to the edge, deep green and rather rough above, paler and covered with very fine short hairs beneath, thin. Flowers small, appearing before the leaves, very shortly stalked, pedicels fleshy, articulated near the base, arranged in small clusters of about 20 flowers in the axils of the leaf-scars of the previous year; bracts oblong, rather longer than the pedicels, orange, ciliated. Perianth funnel-shaped or campanulate, with 5 (rarely 4) rather shallow, triangular, sub-acute lobes, rough with minute hairs, delicately ciliate, purple, persistent. Stamens 5 (or 4), inserted on the base of the perianth-tube and opposite to

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* *Ulmus*, the Latin name for the tree; the Greek name was πτελέα.

its lobes, filaments slender, incurved in the bud, afterwards exserted, anthers 2-celled, dorsifixed, introrse, pink becoming purple, the connective dilated. Ovary superior, ovoid, much compressed, smooth, 2-celled, with a single pendulous ovule in each cell; style none; stigmas 2, large, curved, villous along the inner edge. Fruit (samara) $\frac{1}{2}$—$\frac{3}{4}$ inch long, supported on the persistent perianth, dry, membranous, flat, broadly oblong or obovate, entire, deeply notched at the rounded apex, 1-celled, the ovoid compressed cavity placed above the middle near the notch, and completely surrounded by the thin papery, smooth, radiately-veined, pale, dull yellow wing. Seed (not seen) solitary, pendulous, testa membranous, marked with the lateral raphe, embryo straight, radicle short, superior, cotyledons fleshy, flat, obovate; no endosperm.

Habitat.—There are few trees better known in England than the Elm, which is common throughout the country. It is, however, not a native of our islands, though a very ancient denizen, and is always a planted tree. The flowers appear very early in spring before the leaves, in March and April, and are succeeded rapidly by the little leaf-like fruits, which attain nearly their full size, and then fall without perfecting the seed. This species of Elm is very variable, and botanists have described several species, differing in the size and form of the leaves and the amount of pubescence on the under surface, as well as the mode of growth of the tree; but they are defined with difficulty, and may be considered as merely varieties. In *U. suberosa* Ehrh. the bark developes more or less thick and ridged corky wings.

In Central and Southern Europe the Elm is very common, and it extends, indeed, into Scandinavia, but the original home of the tree is probably in Eastern Europe and Asia; its range now includes also North Africa, Asia Minor, Siberia, &c., Northern India and China.

The native Elm of England is *U. montana*, Sm., known as the Wych Elm, which is a smaller tree with more spreading branches, much larger leaves, and a usually rounded samara which always has the seed-cavity situated at about the centre.

Planchon, in DC. Prod., xvii, p. 156; Syme, E. Bot., viii,

p. 137; Hook. f. Stud. Fl., p. 334; Watson, Comp. Cyb. Brit., p. 310; Gren. and Godr., Fl. France, iii, p. 105; Ledebour, Fl. Ross., iii, p. 646; Lindl., Fl. Med., p. 303.

Official Part and Name.—Ulmi Cortex; the dried inner bark, from trees indigenous to, and cultivated in, Britain (B. P.). The dried inner bark (I. P.). It is not official in the Pharmacopœia of the United States, the dried inner bark of *Ulmus fulva* being there official instead of the present bark.

Collection and Preparation.—For medicinal use elm bark should be separated from the tree in the spring, and after the removal of the rough outer corky layer and the middle layer, the liber or inner bark should be quickly dried.

General Characters and Composition.—When prepared as above, elm bark is found in the form of broad flattish pieces, varying in thickness, but rarely more than one eighth of an inch, brownish-yellow in colour, somewhat striated on the inner surface, but smooth on the outer surface, and showing the marks of the knife used in removing the outer layers of bark. It is tough and fibrous, almost inodorous, but with a slightly mucilaginous, bitter, and astringent taste.

The principal constituents of the official elm bark are *mucilage* and *tannic acid.* As ordinarily prepared, when it consists of liber only, it contains no starch, but this latter substance is a constituent of the middle cortical layer. In the summer months a gummy substance is exuded from the bark of the elm tree, which is converted by the action of the air into a brown insoluble matter, which has been called *ulmin.* A decoction of elm bark is turned green by perchloride of iron, and a precipitate is formed in it by a solution of gelatine. When a concentrated decoction is used, the addition of perchloride of iron then produces a brown precipitate.

Medical Properties and Uses.—Elm bark possesses mild astringent, tonic, and demulcent properties, and in full doses it is said to act as a diaphoretic and diuretic. In the form of decoction it has been thought to be useful in chronic skin diseases, more especially those of a squamous character, as lepra, psoriasis, and

herpes. Some practitioners have used it as an alterative instead of sarsaparilla, for which they have regarded it as a good and cheap substitute. As a medicine, however, it is now nearly obsolete.

The dried bark, when ground to powder, has been mixed with meal, in Norway, to make bread in times of scarity.

Per. Mat. Med., vol. ii, pt. 1, p. 363; U. S. Disp., by W. & B., p. 875; Pharmacographia, p. 500; Watts, Dict. Chem., vol. v, p. 936; Steph. and Church., by Burnett, vol. ii, pl. 120; Sigmond, in Med. Bot. Trans., vol. i, p. 169.

DESCRIPTION OF PLATE.

Drawn from specimens collected near London.

1. A twig with flowers.
2. Section of a flower-cluster.
3. A single flower with bract.
4. Vertical section of ovary.
5. A cluster of fruit.
6. A single fruit.
7. A twig with leaves.

(2–4 enlarged.)

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N. Ord. ULMACEÆ.
Tribe *Ulmeæ*.
Genus Ulmus, *Linn.*

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233. Ulmus fulva, *Michaux, Fl. Bor.-Americ.*, i, *p.* 172 (1803).

Slippery Elm. Red Elm.

Syn.—U. rubra, *Mich. fil.*
Figure.—Mich. f., N. American Sylva, iii, t. 128.

Description.—A small or moderate-sized tree, rarely reaching 50—60 feet, bark reddish-brown, young twigs pubescent, buds large, the inner scales covered with long orange-red down. Leaves large, alternate, on short cylindrical hairy petioles, blade 4—8 inches long, oblong-oval, acute or acuminate, very unequal at the rounded or subcordate base, strongly doubly serrate, rough with very short stiff hairs above, thickly pubescent beneath. Flowers nearly sessile or shortly stalked, arranged as in *U. campestris*, bracts with long rufous hairs. Perianth as in the last, but somewhat larger, more deeply cut into 6—9 lobes, and covered with long rufous hairs. Stamens 6—9. Pistil as in the last. Fruit much like that of *U. campestris*, but usually more orbicular in outline, the seed-cavity placed about the centre of the fruit, silky with short fulvous hairs.

Habitat.—This is the North American Elm, and is common in elevated and open places, banks of rivers, &c., in Canada and the North United States, extending southwards to Western Florida, in woods. It flowers in March and April, and the fruit is ripe by end of May. *U. fulva* is a near ally of the English *U. montana*. It can, however, be easily recognised by its large rufous-hairy buds and the very rough upper surface of the leaves.

A. Gray, Man. Bot. U. States, p. 442; Chapman, Fl. South States, p. 416; Planchon, DC. Prod., xvii, p. 161; Lindl., Fl. Med., p. 303.

Official Part and Names.—ULMUS, *Slippery Elm Bark*; the

inner bark (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India.

Collection and Preparation.—Slippery Elm bark should be collected in the spring, and when deprived of its outer layers, dried. In collecting the bark the tree is destroyed, and as the wood is of no commercial value, no effort is made to cultivate the plant, or replace the loss. Thus while the demand for this bark is increasing year by year, the supply is diminishing, and the collectors who formerly obtained it in large quantities in New York and other eastern states, have now to go westward for their supplies.

General Characters and Composition.—Slippery elm bark or *red elm bark* is found in the form of powder, or cut into small pieces, or in flattish pieces of variable size. The latter condition is that in which it is more commonly found in the pharmacies of the United States. The pieces are frequently two or three feet long, several inches broad, and from one to two lines thick. Externally it has a reddish-yellow colour, the reddish tint being more evident on its inner surface ; and it is so extremely tough and fibrous that it may be bent double without breaking. It has a peculiar sweetish odour, which resembles fenugreek, and a very mucilaginous taste when chewed. The powder has a light greyish-fawn colour. Much of the powdered elm bark found in the United States is said to be adulterated with starchy matter, probably flour.

Wood and Bache say that much of the bark brought into the market is of inferior quality, being very deficient in mucilage. It has, however, " the characteristic odour of the best bark, but is much less fibrous and more brittle, breaking abruptly when bent instead of being capable, like the better kind, of being folded lengthwise without breaking." It is uncertain to what this inferiority is owing, whether to difference in the species, or the age, or to circumstances in the growth of the tree producing it.

The principal constituent of slippery elm bark is a peculiar *mucilage,* which is readily imparted to either cold or hot water, forming a very viscid mixture, but not a true solution. The

mucilage is copiously precipitated by the solution both of the acetate and subacetate of lead, but not by alcohol.

Medical Properties and Uses.—Slippery elm bark is a valuable demulcent, and is applicable in all cases where this class of medicines is required. It is much employed in the United States, both externally and internally. It is usually administered in the form of an infusion, and is especially recommended in catarrhal affections, diarrhœa, dysentery, and diseases of the urinary passages. In cases of external inflammation the infusion is also regarded as an excellent application. The powder is much used for making an emollient poultice ; or in some cases the bark, previously softened by boiling water, is employed as an emollient application. More recently, the bark has also been recommended for the dilatation of strictures and fistulas. The mucilage possesses nutritive properties, and it is said, that in consequence, the bark has been sufficient for the support of life for some days, when no other food could be obtained.

It is also stated that slippery elm bark has the property of preserving fatty substances, such as butter and lard, from rancidity, when these are melted with it and kept in contact for some time.

Per. Mat. Med., vol. ii, pt. 1, p. 364; Pharmacographia, p. 501; U. S. Disp., by W. & B., p. 876; Wood, Ther. and Pharm., vol. ii, p. 804; Proc. Amer. Pharm. Assoc., vol. xxi, p. 435; Amer. Journ. of Pharm., vol. xxiv, p. 180.

DESCRIPTION OF PLATE.

Drawn chiefly from a specimen in the British Museum collected by Bartram in N. America.

1, 2. A flower.
3. A fruit.
4. Twig with leaves.
5. A large full-grown leaf.
(2 enlarged.)

SALIX ALBA, *Linn.*

D.Blair F.L.S. ad sicc. del. et lith.

M & N. Hanhart imp.

N. Ord. SALICINEÆ. Lindl., Veg. Kingd., p. 254; Le Maout & Dec., p. 685.

Genus Salix,* *Linn.* Andersson, in DC. Prod., xvi, pt. 2, pp. 191—323. Species very variously estimated, say about 200; found in nearly all parts of the world.

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234. Salix alba, *Linn., Sp. Plant., ed.* 1, *p.* 1021 (1753).

White Willow. Golden Willow.

Syn.—S. cœrulea, *Sm.* S. vitellina, *Linn.*

Figures.—Woodville, vol. v; Hayne, xiii, t. 42; Nees, Supp.; Syme, E. Bot., viii, tt. 1309—11; Reich., Ic. Fl. Germ., xi, t. 608.

Description.—A large tree, attaining a height of 60 feet or more, with numerous ascending branches, bark grey or yellow, furrowed, young shoots and buds white and silky. Leaves numerous, alternate, on short silky petioles; stipules small, lanceolate or subulate, erect, soon falling, blade 3—4 inches long, narrowly lanceolate-oblong, tapering and very acute at the apex, tapering at the base, shallowly serrate on the margin, with very forward-pointing, gland-tipped teeth, whitish with adpressed silky hairs on both surfaces but especially beneath, often becoming glabrous above when old, midrib prominent on the under surface. Flowers very small, numerous, unisexual, dicœcious, sessile, each in the axil of a small oval-oblong, sub-acute, ciliated, scaly bract, closely placed to form slender, cylindrical, spreading or erect spikes (catkins) about $1\frac{1}{2}$—$2\frac{1}{2}$ inches long, borne on short lateral leafy branchlets and appearing with the young leaves. Male flowers:—perianth none unless represented by two very small glandular scales (disk, nectary); stamens 2, distinct, filaments rather long, stiff, hairy below, anthers small, 2-celled, roundish, yellow. Female flowers:—perianth none, scales as in the male flowers; pistil sessile, ovary ovate, tapering, smooth, 1-celled, with numerous parietal ovules, style very short, stigmas 2, spreading, each divided into 2 lobes. Fruit very small, dry, conical, dehiscing loculicidally

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* *Salix*, the classical Latin name for the willow.

from above into 2 recurved valves, 1-celled. Seeds numerous, very small, each surrounded by a ring of long silky hairs (arillus), which come off from the very short funicle ; embryo with flat oval cotyledons, radicle inferior, no endosperm.

Habitat.—A common tree on river banks, the sides of streams and ditches, and in marshy ground, but very frequently planted, and possibly originally introduced. In such situations it is found throughout England and the greater part of Scotland, and has a very extensive range throughout Central and South Europe, Northern Africa, and temperate Asia, Syria, and Persia, to the Himalayas. It has been introduced into America. The flowers are produced in April and May with the young leaves, and the male catkins soon fall.

The foliage presents some variation in the amount of silkiness. The variety called *S. vitellina* may be known by its polished golden-orange twigs and the long scales of the catkins. Andersson describes many other varieties.

Andersson, in DC. Prod., xvi, 2, p. 211; Syme, E. Bot., viii, p. 210; Hook. f., Stud. Fl., p. 337; Watson, Comp. Cyb. Brit., p. 314; Gren. and Godr., Flore de France, iii, p. 125; Ledebour, Fl. Ross., iii, p. 598; Lindl., Fl. Med., p. 318.

Official Part and Name.—Salix; the bark of Salix alba (U. S. P. *Secondary*). It is not official in the British Pharmacopœia, or the Pharmacopœia of India. But the barks of *Salix alba, Salix caprea, Salix fragilis,* and other species of *Salix,* were formerly official in the London, Edinburgh, or Dublin Pharmacopœias.

General Characters and Composition.—The Willow bark of commerce is derived from various species and varieties of *Salix,* and varies in its characters accordingly. It is generally obtained from the branches, and then, when dried, it is thin, quilled, of a brownish colour externally, whitish within, tough, fibrous, and difficult to powder, with a feeble, somewhat aromatic odour, and a bitter astringent taste. Those barks which have the most bitter taste are usually regarded as the best. Great difference of opinion has, however, prevailed as to which species possessed the most medicinal power. The bark of *Salix*

Russelliana, Smith, the *Bedford Willow*, was regarded by Sir J. E. Smith as the most valuable species; but, as remarked by Lindley, if the medicinal qualities of Willow bark are dependent upon its bitterness, that of *Salix purpurea*, Linn., which is the most bitter, should be the best.

The principal constituents of Willow bark are *tannic acid* and a peculiar neutral principle called *salicin*. The amount of tannic acid is so considerable in willow bark that it has been used for tanning, and it is said to be especially abundant in the bark of *Salix Russelliana*. Both water and alcohol take up the active properties of the bark. *Salicin* has been obtained from more than twenty species of *Salix*, and also from several species of *Populus;* the barks of *S. Russelliana*, *S. alba*, *S. caprea*, *S. fragilis*, *S. pentandra*, and *S. purpurea*, are said to yield it in the largest proportion; but further experiments are required on this point. Salicin, when pure, occurs in white scaly crystals, which have a very bitter taste; they are soluble in both alcohol and water, but are insoluble in ether. Concentrated sulphuric acid decomposes it, producing a bright red colour. Salicin is a neutral glucoside, for when boiled with dilute sulphuric acid, or when acted upon by emulsin, it is converted into *glucose* and *saligenin*, which latter substance is a diatomic phenol-alcohol, crystallizing in pearly scales, which are soluble in water. When gently heated with sulphuric acid and bichromate of potash, salicin is converted into the fragrant *oil of meadow sweet, hydride of salicyl*, or *salicylous acid*, which differs only in composition from *salicylic acid* by containing an atom less of oxygen. *Salicylic acid* was formerly obtained from the willow, meadow sweet (*Spiræa Ulmaria*), and winter-green (*Gaultheria procumbens*), but it is now very largely prepared from carbolic acid. Salicylic acid is also contained in oil of cloves. *Salicin* may be obtained by boiling an aqueous infusion of willow bark with hydrated oxide of lead, which precipitates the tannin and colouring matter; then filtering and evaporating the solution, when the salicin is deposited, and may be purified by repeated solution and crystallization.

Medical Properties and Uses.—Willow bark possesses tonic and astringent properties, and has been employed as a substitute for cinchona bark in intermittent fevers. It owes its activity to the presence of salicin, in which form it is usually administered. From the testimony of numerous practitioners in this country, on the Continent of Europe, and in the United States, there appears to be little doubt that salicin has to some extent antiperiodic properties, but far inferior in this respect to quinia. Garrod only regards it as possibly useful as a mild bitter tonic, when given in doses of from ten to twenty grains. He states that he "has made many trials of salicin in cases both of ague and of intermittent neuralgia, and his experience amounts to this,—that salicin is a drug devoid of any true antiperiodic property, twenty to thirty grains given three times a day failed to check ague, but the patients were subsequently cured at once by the exhibition of quinine; and the same negative results were found to follow its administration in neuralgia." When taken internally, salicin is eliminated in the urine as hydride of salicyl, the secretion then giving a purple-red colour with the persalts of iron. Recently, Senator has obtained very favorable results from the administration of salicin in various febrile complaints such as typhus, &c. Salicin has also been given with success by Maclagan and Senator in acute rheumatism.

The decoction of willow bark has been found beneficial as an application to foul and indolent ulcers; and in chronic skin affections, as psoriasis.

Recently, salicylic acid and its salts, more especially salicylate of soda, have been extensively used in medicine; and as a remedy in rheumatism, and some other diseases, the powers of salicylic acid may be considered as established. Salicylic acid has also been largely employed as a preservative agent, and has been proved to possess powerful antiseptic properties; in fact, these properties of salicylic acid are now extensively utilised in beer brewing, the preservation of fruits, and in other ways. It is also now largely used instead of carbolic acid in antiseptic surgery. Dr. Fergus has recently recommended salicylic acid as a topical

application in diphtheria. It has also been successfully used as an internal remedy in diphtheria. Salicylic acid is said to have an injurious effect upon the teeth, hence Dr. Buch strongly cautions the public against the use of salicylic acid as a wash for the mouth and teeth. All persons, therefore, using this acid or its salts, should rinse the mouth with water after taking a dose of either of them.

Per. Mat. Med., vol. ii, pt. 1, p. 338; Lindl., Flor. Med., p. 317, Steph. & Church., Med. Bot., by Burnett, vol. iii, pl. 139; Watts, Dict. Chem., vol. v, p 147; Garr., Mat. Med., p. 352; U. S. Disp., by W. & B., p. 765; Kolbe, in Pharm. Journ., vol. v, ser. 3, p. 421; Benger, in Pharm. Journ., vol. vi, ser. 3, p. 210; Hunter, in Pharm. Journ., vol. vii, ser. 3, p. 276; Williams, in Pharm. Journ., vol. viii, ser. 3, p. 785; Several Papers in Year-Book of Pharmacy for 1875, 1876, and 1877; Proc. Amer. Pharm. Assoc., vol. xxiv, p. 369.

DESCRIPTION OF PLATE.

Drawn from specimens collected near London and in Lancashire.

1. A branchlet of the male tree with flowers.
2. A male flower.
3. A branchlet of a female tree with flowers.
4. A female flower.

5, 6. Fruit dehiscing.

7, 8. A seed.

9. Twig with leaves.

(2, 4, 6, 8 enlarged.)

D.Blair F.L.S. ad sicc. del. et lith.

MANIHOT UTILISSIMA, *Pohl.*

M & N. Hanhart imp.

N. Ord. EUPHORBIACEÆ. Lindl., Veg. Kingd., p. 274; Baill., Hist. Pl., v; Le Maout & Dec., p. 687.

Tribe *Hippomaneæ*.

Genus **Manihot**,* *Adans.* Baill., Hist. Pl., v, p. 180. Over 70 species have been described, natives of tropical parts of the New World.

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235. Manihot utilissima, *Pohl, Plant. Brasil. Ic. & Descript.*, i, *p.* 32 (1827).

Manioc. Mandioc. Cassava. Cassada.

Syn.—Jatropha Manihot, *Linn.* Janipha Manihot, *Kunth.* M. edule, *A. Rich.*

Figures.—Tussac, Fl. des Antilles, iii, t. 1; Pohl, loc. cit., t. 24; Berg, Characterist., t. 24, fig. 199; Bot. Mag., t. 3071; Fl. Brasil., fasc. 64, t. 65.

Description.—A herbaceous or semi-shrubby perennial, with very large, cylindrical, tapering, fleshy, yellowish roots, reaching as much as 3 feet long and 6 to 9 inches in diameter, filled with a milky juice. Stems slender, 5 to 9 feet in height, somewhat woody below, with a whitish bark, erect, cylindrical, often somewhat zigzag, smooth, purplish and glaucous, branched above. Leaves large, spreading, alternate, on long slender cylindrical purplish stalks, deciduous just above the base and leaving that as a wart-like, flat-topped projection from the stem. Stipules about $\frac{1}{4}$ inch long, narrowly triangular-linear, acute, smooth, usually deciduous; blade 3—4 inches long, palmate, very deeply divided nearly to the base into 3—7 nearly equal linear-oblong or oval-oblong segments, which are usually somewhat narrowed below, acute or acuminate, entire, glabrous and dull green above, very glaucous and sometimes puberulous on the prominent yellowish veins beneath, thin, deflexed and reddish when young. Flowers unisexual, monœcious, of moderate size, the female the larger, on slender pedicels, arranged in small few-flowered stalked racemose

* *Manihot*, given as the native Brazilian name for the present species in the early Spanish treatises of the 16th century.

panicles 4 or 5 inches long, several of which come off together from the forks of the branches, flowers of each sex mixed, or the male flowers above and female below, bracts large, narrow, articulated, early caducous. Male flowers :—perianth bell-shaped, deeply cut about half way down into 5 acute segments, dull orange or yellow, purplish outside, smooth ; stamens 10, distinct, filaments shorter than the perianth, slender, somewhat unequal, anthers oblong, yellow, inserted beneath the large, flat, orange-coloured, fleshy disc, which is deeply 10-lobed, with the lobes projecting between the bases of the filaments ; no pistil. Female flowers :—perianth much as in the male, but more deeply cut ; stamens none ; ovary surrounded at the base by an annular, succulent, orange disc, ovoid-conical, smooth, purple, with 6 thick, lobed, blunt, narrow wings or ridges down the sides, 3-celled, with one ovule in each cell ; style short, stigmas 3, spreading or reflexed, lobed, and plaited, white. Fruit shortly stalked, about $\frac{1}{2}$ inch long, globose-ovoid, glabrous but rough with raised ridged prominences, with 6 thick, narrow, rather undulated wings, the 3 down the backs of the carpels the most prominent, 3-celled, dehiscing septicidally into 3 cocci, which also separate from the axis and dehisce along the ventral suture (septifragal). Seeds solitary in each coccus, about $\frac{1}{6}$ inch long, oblong, compressed, smooth, grey, with a prominent caruncle round the hilum, cotyledons foliaceous.

Habitat.—A plant much cultivated throughout the tropics, especially in the New World. There is good reason to believe it indigenous to Brazil, where it was in common cultivation when the country was first visited by Europeans ; it does not, however, certainly appear to have been ever met with in a truly wild state, though many other species of the genus are native there. Next to S. America the Cassava is most largely grown in West Tropical Africa ; its cultivation is there universal, and the plant has become semi-spontaneous. It has been in consequence supposed to be indigenous to Africa, but there can be little doubt that it has been in some way or another imported from America. Specimens are grown in the hot-houses of our botanic gardens, but the plant never flowers with us. It seems, indeed, that the flowers are

everywhere somewhat rarely produced; they appear in March and April, and the fruit is ripe in July.

As is usually the case with cultivated plants the Manioc presents considerable variety. The number of segments in the leaves is most usually 5, but varies from 3 to 7, the latter being a frequent number; the depth of the division between them is sometimes much shallower than above described, and a form with entire leaves has been recorded. Varieties are recognised also according to the colour of the stem, red, blue, or blackish. There is also a variety which possesses an innocuous juice in the root.

But the plant usually grown as Sweet Cassava, or Manioc with a non-poisonous juice, is *M. Aipi*, Pohl (*Jatropha dulcis*, Gmel.). This is figured in Pohl's work above quoted, t. 23. It is very similar to *M. utilissima*, with which some botanists place it. Müller, however, regards it as a variety of his *M. palmata*, which is distinguished by the absence of wings on the ovary and capsule, the much larger anthers, and the presence of pubescence on the young shoots, besides the bland character of the roots, which are reddish in colour.

Pohl, Plant. Brasil., i, p. 32; Müller, in DC. Prod., xv, pt. 2, p. 1064, and in Fl. Brasil., fasc. 64, 457; DC. Géogr. Bot., p. 816; Lindl., Fl. Med., p. 185.

Official Part and Name.—Tapioca; the fecula of the root of Janipha Manipha, *Bot. Mag.* (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India, but it was formerly recognised in both the Edinburgh and Dublin Pharmacopœias.

1. General Characters and Products of the Roots.—Two kinds of cassava root are distinguished, which are obtained from different varieties of the plant; these are termed *bitter cassava root* and *sweet cassava root*. A. *Bitter Cassava Root* is large and tubercular, and abounds in a poisonous milky juice. It is difficult to distinguish it by its appearance from the sweet cassava root, but it is devoid of the tough, fibrous, or woody portions found in the centre of that root, and it does not become soft like it by boiling or roasting. The meal known as *cassava meal* is obtained

by subjecting the grated root to pressure to express the juice, and then drying and pounding the residual cake. Of this meal *cassava bread* is made. This is found in thin cakes, which are prepared by gently heating the moistened meal, and then drying it in the sun. The expressed juice of the root by standing deposits the starch called cassava starch, of which the official tapioca is made. This juice, freed from starch, and boiled, is commonly regarded as a powerful antiseptic, but Attfield has conclusively shown that its powers in that respect are very slight. The sauce called *cassareep* is made from the juice concentrated by heat, which dissipates its poisonous properties, and afterwards flavoured by aromatics. Cassareep, when mixed with peppers and meat, forms the West Indian "pepper-pot." B. *Sweet Cassava Root* resembles the bitter, as already noticed, in external appearance, but, unlike the latter, it is not poisonous, and may be eaten with impunity. It is a common article of food in the West Indies and some parts of South America, when boiled or roasted. It is as mealy as a potato when boiled. The expressed juice of the root, when fermented, constitutes the intoxicating liquor drunk by the Indians, and called *Piwarry*. *Cassava meal* and *bread, cassava starch,* and *tapioca,* are prepared from the sweet, as well as the bitter cassava root.

Composition.—The principal constituent of both the bitter and sweet cassava roots is starch. Bitter cassava root also yields *hydrocyanic acid* to which its poisonous properties are due.

2. Cassava Starch or Tapioca Meal.—This starch is found in two states, which are known under the names of *cassava starch* and *tapioca.* A. *Cassava starch; tapioca meal;* or *Brazilian arrow-root.* This is the meal deposited from the expressed juice of the cassava roots after being washed and dried in the air without heat. It is usually imported from Rio Janeiro. It is white and pulverulent, and resembles in external appearance Maranta starch. When examined by the microscope it is, however, readily distinguished, for it is then seen to consist of small single granules, which are generally mullar-shaped, and when seen endwise they appear circular or globular. Some are

also truncated ovate granules. The hilum is circular, cracked in a stellate manner, and surrounded with rings. These microscopic and other characters apply equally to both *bitter cassava starch* and *sweet cassava starch.* B. *Tapioca.*—This, which is official in the Pharmacopœia of the United States, is imported from Rio Janeiro and Bahia. The tapioca imported from Rio is always much whiter, and has a more pearl-like appearance than that from Bahia, which is coarse and has a yellowish tint. Tapioca is nothing more than cassava starch which while moist or damp, has been heated on hot plates. By this treatment the starch granules swell, many of them burst, and the whole agglomerate in small irregular masses or lumps. In consequence of the change thus effected in the starch granules, tapioca is partially soluble in cold water, and the filtered cold solution strikes a blue colour with tincture of iodine. In boiling water it swells up, and forms a transparent, viscous, jelly-like mass.

Properties and Uses.—The effects and uses of tapioca are like those of other starches. It is entirely devoid of irritating and stimulating properties. Made into puddings, it is extensively employed as a dietetical substance. Boiled in water or milk, and flavoured with sugar, spices, or wine, according to circumstances, it is used as an agreeable, nutritious, and easily digestible article of food for the sick and convalescent. It is also much used for infants at the time of weaning.

Per. Mat. Med., vol. ii, pt. 1, p. 429; Christison, Disp., p. 909; U. S. Disp., by W. & B., p. 858; Shier, Report on the Starch-producing Plants of British Guiana, Demerara, 1847; Hamilton, in Pharm. Journ., vol. v, ser. 1, p. 27 ;Henry and Boutron-Chalard, Journ. de Pharm., vol. xxii, p. 118; Pharm. Journ., vol. vii, ser. 1, p. 197, and vol. ii, p. 248; Pharm. Journ., vol. vi, ser. 2, p. 302, and vol. ii, p. 13; Attfield, in Pharm. Journ., vol. i, ser. 3, p. 274; Pharm. Journ., vol. iii, ser. 3, p. 569.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum, collected by Welwitsch in Angola, Africa (no. 301).

1. Upper part of a branch with flowers.
2. Vertical section of a male flower.
3. Disc of the same.
4. Vertical section of female flower.
5. Ovary.
6. Transverse section of the same.

8, 9. Seeds.

(2–5 enlarged.)

D.Blair ad sicc.del,et lith.

M&N Hanhart imp

N. Ord. EUPHORBIACEÆ.

Tribe *Acalypheæ*.

Genus Mallotus,* *Loureiro*. Müll. Arg. in DC., l. c., pp. 956—983; Baill., Hist. Pl., v, p. 196. Species 72, natives of the hot parts of the Old World.

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236. Mallotus philippinensis, *Müll. Arg. in Linnæa*, xxxiv, *p.* 196 (1865).

Kamela, Kamal, &c. (N. India), *Punnāga Kesara* (Sanskrit).

Syn.—Croton philippense, *Lam.* (1786). C. punctatus, *Retz.* C. coccineus, *Willd.* Rottlera† tinctoria, *Roxb.* (1798). R. aurantiaca, *H. & A.* Echinus philippinensis, *Baill.*

Figures.—Rheede, Hort. Malab., pt. 5, t. 21 (and t. 24, which represents a state with fasciated branches); Roxb. Corom. Pl., iii, t. 168; Beddome, Fl. Sylv., t. 289.

Description.—A tree of 20—30 feet, with a trunk 3—4 feet round; branches slender, with a pale bark, the younger ones covered with a more or less dense ferrugineous tomentum. Leaves articulated, alternate, petioles 1—2 inches long, rusty-tomentose, swollen at the end, blade 3—6 or more inches long, ovate or rhombic-ovate, with two obscure glands at the base, entire, coriaceous, upper surface glabrous, 3-nerved at base, veins very prominent on under surface, which is densely covered with a tomentum of minute, rusty, stellate hairs. Flowers dicœcious; female flowers in lax spike-like terminal and axillary racemes; male flowers 3 together in the axils of small bracts, arranged in longer often much branched axillary panicles; both more or less set with ferrugineous tomentum. Male flowers:—perianth of 3 or 4 thin lanceolate reflexed leaves; stamens about 20 or more on long filaments, the connective tipped by a small red gland. Female flowers:—perianth of 2 (3, or more) broadly ovate leaves slightly

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* From μαλλωτός, woolly.

† Named after the Rev. Dr. Rottler, a Danish missionary at Tranquebar, in India, who died in 1836.

connected below; ovary included in the perianth, densely clothed with a thick covering of stellate hairs and minute red granular bodies; styles 3, broad, spreading, covered on their inner surface with long papillary processes. Capsule trigonous-globular, about $\frac{3}{8}$ths of an inch in diameter; pericarp tough, greenish, more or less covered with a bright crimson layer of minute, readily detached granules, dehiscing septifragally by 3 valves. Seeds one in each cell, short, round on back, flat in front, attached to summit of axis, dark purple-brown, smooth, without a caruncle.

Habitat.—This tree is widely distributed through the East, from Abyssinia (Hanbury) to the Indian peninsula, where it is common in the sub-Himalayan tract, ascending to 4500 feet, Ceylon, Malaya, the Philippines, Hongkong, and Australia, flowering November to January. It is cultivated in a few botanic gardens in this country, but has not yet flowered with us.

Roxb., Fl. Ind., iii, p. 827; Benth., Fl. Hongkong., p. 307; Benth., Fl. Austral., vi, p. 141; Müll. Arg. in DC. Prod., l. c., p. 980; Brandis, Forest Fl. Ind., p. 444.

Official Part and Names.—KAMALA. A powder which consists of the minute glands that cover the capsules of Rottlera tinctoria, *Roxb.* (B. P.)—A powder which consists of minute glands (*Kamala*) that cover the capsules (I. P.)—ROTTLERA, *Kameela.* The glandular powder and hairs obtained from the capsules of Rottlera tinctoria, *Roxburgh* (U. S. P. *Secondary*).

Production and Collection.—Kamala is produced in several parts of India, from which it is imported into this country and elsewhere. The following particulars of its collection in the north-west provinces of the Madras Presidency are derived from *Pharmacographia* :—"Enormous quantities of *Rottlera tinctoria* are found growing at the feet of these hills, and every season numbers of people, chiefly women and children, are engaged in collecting the powder for exportation to the plains. They gather the berries in large quantities, and throw them into a great basket, in which they roll them about, rubbing them with their hands so as to divest them of the powder, which falls

through the basket as through a sieve, and is received below on a cloth spread for the purpose. This powder forms the *Kamala* of commerce, and is in great repute as an anthelminitic, but is most extensively used as a dye. The adulterations are chiefly the powdered leaves, and the fruit-stalks with a little earthy matter, but the percentage is not large. The operations of picking the fruit and rubbing off the powder commence here in the beginning of March and last about a month." Kamala is also collected in Eastern Africa and Southern Arabia.

General Characters and Composition. — Kamala is a fine, granular, mobile powder, of a brick-red or madder colour, with but little smell or taste. It is insoluble in cold water, and nearly so in boiling water, but ether, alcohol, chloroform, and benzol dissolve its resinous portion, and form deep red solutions. It resembles lycopodium by floating on water, and by igniting when sprinkled over a flame. When examined by a microscope it is seen to consist of minute irregular spherical, semi-transparent, garnet-red glands with a wavy surface, more or less mixed with stellate hairs and sand. The glands or pure kamala may be removed by sifting.

Much doubt exists as to the chemical constitution of kamala. Some years since Dr. Thomas Anderson, of Glasgow, obtained a principle, which he called *Rottlerin*, in the form of minute, yellow, platy crystals with a satiny lustre. These crystals were readily soluble in water, sparingly soluble in cold alcohol, but more so in hot alcohol, and insoluble in water. Leube, who afterwards examined kamala, was unable to obtain this principle, but he found two resins which together formed 80 per cent. of the drug, and these he regarded as the active constituents. It is certain, however, that minute crystals may be obtained in some cases from an ethereal solution of kamala by spontaneous evaporation, but the exact nature of these crystals is unknown.

Medical Properties and Uses.—Kamala acts speedily and actively as a purgative, but it not unfrequently causes much nausea and griping. In India it has long been employed as an anthelmintic, being especially adapted for the expulsion of tape-worm. Dr. Mac-

kinnon, after an extended trial, says that kamala is a safe and efficient remedy for tape-worm, and more certain than either turpentine or kousso. Dr. Anderson, an army surgeon in India, also speaks highly of its value. He writes, "The worm is generally passed entire, and almost always dead, and in all the cases I have examined (fifteen) I was able to detect the head." It is, however, but little esteemed in this country as an anthelmintic, fern rhizome being generally regarded as more efficacious. Garrod says, however, that he has used it with success in some cases. Kamala has also been used externally in this country in herpetic ring-worm. In India kamala is also frequently employed as an external application in scabies and various other affections of the skin. It is also used in India for dyeing silk a rich orange-brown. The dye is also known at Aden under the name of *Waras* or *Wurrus*.

Pharmacographia, p. 515; Ph. Jl., vol. xii (1853), 386, 589, and vol. xvii (1858), 408; Per. Mat. Med., by B. and R., p. 536; U. S. Disp., by W. and B., p. 744; Gar. Mat. Med. p. 312.

DESCRIPTION OF PLATE.

Drawn from Indian specimens in the herbarium of the Brit. Museum, the male plant collected by Wallich; the female collected by Dr. Thomson. 1. A male panicle. 2. A male flower. 3. Extremity of branch of a female plant. 4. A female flower. 5. Vertical section of the same. 6. Transverse section of the ovary. 7 and 8. Fruit. 9. Front and 10. Back view of a seed. 11. Some of the small glands removed from the capsule. (2, 4—6, and 8 enlarged. 11 greatly magnified.)

D.Blair ad nat. del. et lith.

RICINUS

NIS, *Linn.*

M & N Hanhart imp

N. Ord. EUPHORBIACEÆ.

Tribe *Acalypheæ*.

Genus Ricinus,* *Linn.* Müll. Arg. in DC. Prod., xv, pt. 2, pp. 1016-21; Baill., Hist. Pl., v, p. 109. Species a single very variable one.

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237. Ricinus communis, *Linn., Sp. Plant. ed.* 1, *p.* 1007 (1753).

Palma-Christi. Castor Oil.

Syn.—R. europæus, *Nees.* R. lævis, *DC.* R. viridis, *Willd.* R. lividus, *Jacq.* R. africanus, *Mill.* &c. &c.

Figures.—Woodville, t. 221; Nees, t. 140; Hayne, x, t. 48; Steph. & Ch., t. 50; Berg & Sch., t. 1 c; Flora Græca, t. 952; Nees, Gen. Fl. Germ.; Baill., l. c., f. 153–162.

Description.—Very variable in habit and appearance; in tropical countries a tree reaching 40 feet high, in warm, temperate regions a slender, woody, branching bush of 12—14 feet, in this country a very large branched, annual herb 4 or 5 feet high; herbaceous stems hollow, smooth, cylindrical, glaucous, with a purplish bloom in the upper part. Leaves alternate, on long, curved, cylindrical, purplish petioles, sub-peltate, drooping, stipules large, ovate, yellowish, united into a cap enclosing the buds, deciduous, blade 6—8 inches across, palmately cut for three quarters of its depth into 7—11 lanceolate, acute, coarsely serrate segments, smooth, blue-green, paler beneath, red and shining when young. Flowers monœcious, large, arranged on the thick rachis of an oblong, spicate panicle, which is at first terminal but becomes lateral by the growth of an axillary bud beneath it; male flowers shortly stalked, on branched peduncles at the base of the panicle, pedicels articulated about the middle; female flowers sessile, at the upper part; bracts broadly triangular. Male flowers: Calyx deeply cut into 3—5 smooth, broadly ovate, pointed segments, valvate in æstivation; petals none; stamens very numerous, irregularly combined into many much branched, compound stamens,

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* *Ricinus*, a dog-tick, from the form of the seed; the plant was called κίκι and κροτών by the Greeks, the latter word having the same meaning.

inserted on the raised centre of the receptacle, anthers small, 2-celled, dehiscing longitudinally. Female flowers: Calyx as in the male, but more deeply cut, with the segments narrower, more acute and erect; petals none; ovary shorter than the calyx, superior, globular-trigonous, with the blunt angles bearing several lines of large, soft, erect, finger-shaped prominences, tipped with a transparent spiny bristle, 3-celled, with a single ovule attached to the top of the axis in each cell, style very deeply divided into three long, flattened branches, each split into two, the inner surface covered with papillæ, bright carmine-red. Fruit a blunt, greenish, deeply-grooved, tricoccous capsule, less than an inch long, with the prominences of the ovary become sharp, weak, spreading spines, 3-celled, dehiscing loculicidally and septicidally into 6 valves. Seeds ovoid, flattened, nearly $\frac{5}{8}$ inch long by $\frac{1}{4}$ broad, smooth, shining, pinkish-grey, prettily mottled with dark brown, caruncle large, subglobular, raphe faintly raised, running down centre of ventral surface, embryo large in axis of the endosperm, cotyledons foliaceous, broadly ovate, with a cordate base, veined.

Habitat.—It is believed that this well-known plant is a native of India, and that it has spread thence over all the warmer countries of the world. In the Mediterranean region, especially in Spain and Sicily, where it occurs as a bush or small tree, it has quite the look of a native plant. It is cultivated for medicinal purposes in India, Italy, and other countries; in England it is only grown as a garden ornament and is an annual. The known varieties are very numerous, and have mostly been described as species. Müller groups them in one species under 16, distinguished by the varying size and form of the capsules and seeds; the colour of the latter varies also considerably, and the spines on the capsule are sometimes quite absent.

The name "Castor" was originally applied to this plant in Jamaica, where it seems to have been called "Agnus Castus," though it bears no resemblance to the South European plant properly so named (*Vitex Agnus-Castus*, L.).

Müll. Arg. in DC., l. c., p. 1017; Lindl., Fl. Med., p. 183; Pappe,

Fl. Cap. Med. Prodr., p. 37; Gris, in Ann. des Sc. Naturelles, ser. 4, xv, p. 5.

Official Parts and Names.—Oleum Ricini; the oil expressed from the seeds (B. P.). The seeds (*Ricini Semina*) (I. P.). Oleum Ricini; the fixed oil obtained from the seed (U. S. P.).

1. The Seeds.—The seeds are oval, somewhat compressed, convex on one side, and with two flattish surfaces on the other; varying in length from about $\frac{1}{3}$ to over $\frac{1}{2}$ an inch, and in breadth from $\frac{1}{4}$ to $\frac{4}{10}$ of an inch, and about $\frac{1}{8}$ of an inch thick; ordinarily they may be described as being about the size of a coffee grain, or small bean. In India two varieties of the seed are distinguished, the large and the small; the latter being usually considered to yield the better product. A fleshy, tumid process, termed a caruncule or strophiole, is situated at one end of the seed, or if this is broken off, a blackish scar remains. Externally, the seeds are very smooth and shining, and of a greyish colour, marbled with brownish or blackish bands and spots, of various tints and shapes, so as to give the seeds a great variety of appearances. In one hundred parts of castor oil seeds Geiger found, exclusive of moisture, 23·82 parts of seed-coats, and 69·09 of nucleus or kernel, which is of a whitish colour. The seed-coats are without taste or odour; but if not rancid, the nucleus has a bland sweetish taste, succeeded by a very slight degree of acridity.

The principal constituent of the nucleus is the fixed oil, commonly called Castor Oil, which is described below. The seeds are only official in the Pharmacopœia of India as the source of the oil; of which the nucleus yields from about 40 to 50 per cent. The other constituents of the seeds are, about 20 per cent. of *albuminoid matters*, 2·2 of *sugar* and *mucilage*, and about 18 per cent. of *cellulose*. Professor Tuson has also indicated the presence of a crystalline alkaloid, which he has named *Ricinine*, but his results have been called in question by Werner, and recently by E. S. Wayne, of Cincinnati; he still, however, maintains the correctness of his conclusions. The seeds are also supposed to contain a very small portion of some acrid purgative principle; but this matter has not been isolated. But a small proportion of this purgative principle is contained in the castor oil as ordinarily

obtained by expression, for the oil obtained by absolute alcohol from castor oil seeds, as well as the seeds themselves, or an emulsion prepared with them, have a far more powerful purgative action than the expressed oil.

2. Oleum Ricini. *Castor Oil.—Production, Varieties, and Commerce.* Castor oil may be obtained from the seeds in three ways :— 1. by decoction ; 2. by expression ; and 3. by some solvent, as alcohol. All the oil, however, now consumed in England, India, and the United States ; and with few exceptions, in other parts of the world, is obtained by expression. All processes in which a high temperature is employed are considered objectionable from increasing the acridity of the oil. In India, in order to extract the oil, the seeds are first gently crushed between rollers, and after the seed coats or husks, and unsound seeds, have been removed by hand-picking, the cleaned kernels are submitted to pressure in an hydraulic press ; and the oil thus obtained is first heated with water until the water boils, by which the albuminous matters are separated as a scum ; and the oil is then finally strained through flannel. In the north of Italy, more especially about Verona, the fresh seeds are alone used, and after the seeds have been broken and their integuments very carefully removed with a winnowing machine and by the hand, the blanched seeds are put into small hempen bags, which are arranged in superposed layers in a powerful hydraulic press with a sheet of iron heated to 90° between each layer, so as to enable the oil to flow readily ; they are lastly submitted to pressure in a room, which in the winter is heated to a temperature of about 70°. The oil which first flows is of the finest quality ; but an inferior oil is subsequently obtained by pressing the marc at a somewhat higher temperature.

By somewhat modified processes good castor oil is also obtained in this country and in the United States ; but in the West Indies it is prepared by boiling the crushed seeds after depriving them of their integuments, in water, and afterwards separating the oil by skimming or straining. The oil thus extracted is very inferior to that obtained by expression, as before described.

General Characters and Composition.—Good commercial castor oil has a viscid consistence, and a specific gravity of about 0·96. It is colourless, or pale straw-yellow; with scarcely any odour, and a mild, somewhat unpleasant taste, which is succeeded by a very slight acridity. Inferior oils have a brownish colour, a nauseous odour, and a disagreeable acrid taste. Castor oil is especially distinguished by its ready solubility in absolute alcohol and in glacial acetic acid; it is also soluble in about two volumes of rectified spirit. It does not generally solidify until about 0°; and when exposed to the air in thin layers, it slowly dries up to a varnish, and hence it belongs to the class of drying oils.

When saponified, castor oil yields several fatty acids, one of which is supposed to be *palmitic acid*, and another, which is peculiar to castor oil, is termed *Ricinoleic acid*.

Medical Properties and Uses.—Castor oil is a mild and most efficient purgative, and is well adapted for infants and young children, the puerperal state, and in irritable conditions of the alimentary canal or of the genito-urinary organs. It is one of the safest and most reliable purgatives we possess for the relief of obstinate constipation. It has also been strongly recommended by Dr. Johnson as an eliminant in malignant cholera, and has the high authority of Sir Thomas Watson and numerous other practitioners in its favour.

In India, Algeria, &c., castor oil has been used for burning in lamps, and the inferior qualities are also employed in India for soap-making.

Formerly the seeds were employed as a purgative, but on account of their violent action, they are not now administered.

The leaves have been also recommended in the form of a decoction or poultice, as an application to the breasts of women to increase the secretion of milk. The decoction has also been reputed to act as a lactagogue and emmenagogue when administered internally.

Per. Mat. Med., by B. & R., p. 531; Pharmacographia, p. 512; U. S. Disp., by W. & B., p. 609; Gmelin's Chemistry, vol. xvii (1866), p. 131; Groves, in Pharm. Journ., vol. viii, 2nd ser., p. 250; Amer. Journ. Pharm., vol. xxvi, p. 207, and vol. xxvii,

p. 99; Chemical News, vol. xxii (1870), p. 229; Pharmacopœia of India, pp. 201 and 462.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Garden of the Apothecaries' Company, Chelsea, flowering in September.

1. A flowering top.
2. Section of male flower.
3. A group of united stamens.
4. A female flower.
5. Vertical, and—6. Transverse section of ovary.
7. Fruit.
8. Seed.
9. Vertical, and—10. Transverse section of the same.

(2–6 enlarged.)

D.Blair ad nicc del et lith.

M&N Hanhart imp

CROTON ELUTERIA, *I. J. Benn*

N. Ord. Euphorbiaceæ.

Tribe *Crotoneæ*.

Genus Croton,* *Linn.* (emend). Baill., Hist. Pl., v, p. 129; Müll. Arg. in DC. Prod., xv, sect. 2, pp. 512—700. Species about 450, mostly tropical.

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238. Croton Eluteria,† *J. J. Bennett, in Journ. Linn. Soc.*, iv (1859), *p.* 29 (non *Swartz*).

Sweetwood Bark. Sweet Bark. Bahama Cascarilla.

Syn.—Elutheria, *Linn., Hort. Cliff.* Clutia Eluteria, *Linn., Sp. Plant.*

Figures.—Woodville, t. 223, fig. 2; cop. in Steph. & Ch., t. 150 (drawn from Dean's specimens in Brit. Museum); Daniell, in Pharm. Journ., 1862, 1st plate.

Description.—A compact shrub or small tree, attaining at the most 20 feet, and usually much smaller, with slender wand-like branches, which frequently divide dichotomously at an acute angle. Bark fissured, pale yellow-brown, scented; the young twigs covered with minute peltate scales. Leaves few, alternate, without stipules, on longish petioles; blade $1\frac{1}{2}$—$2\frac{1}{2}$ inches long, ovate-lanceolate, rounded or sub-cordate at the base, much attenuated into the blunt apex; margin somewhat undulated or irregularly dentate; the under surface, as also the petioles, entirely covered, so that the venation is concealed, by a close coating of minute, peltate, radiated scales, white with a bronze centre, giving the surface a metallic bronzed-silver appearance; on the upper surface the scales are entirely white, more scattered, not forming an unbroken layer. Flowers monœcious, in erect axillary racemes; the pedicels and calices rusty-looking, with bronzed stellate scales, bracts shorter than the pedicels, buds nearly globular; petals white. Male flowers numerous in each raceme: calyx deeply 5-partite, the divisions broad and rounded; petals

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* From κροτών, a tick.

† The name *Eluteria* is derived from Eleuthera, one of the Bahama Is. adjacent to Providence Island.

5, fringed; stamens about 15, inserted on the receptacle. Female flowers few at the base of the racemes: calyx deeply 5-partite, the divisions lanceolate, acute; petals 5, fringed, shorter than the calyx; ovary rounded, covered externally with scales, 3-celled, with one suspended ovule in each cell; styles 3, thick, cylindrical, each three times dichotomous. Capsule ovoid, $\frac{3}{5}$ths of an inch long, silvery-grey with stellate scales, 3-celled; pericarp thin, dehiscing septicidally into 3 valves, which afterwards separate from the axis and split loculicidally. Seeds solitary in each cell, smooth, shining, orange-brown, with the caruncle paler; rounded on the back, flat on the sides, and strongly ridged by the ventral raphe; embryo straight in axis of endosperm.

Habitat.—The Sweet Bark grows in all the islands of the Bahamas group, chiefly on low hills, and in Cuba. The British Museum contains also a specimen collected by Michaux in "the southern parts of N. America;" but the species is not included in Chapman's Flora of these States. The shrub is said to have been introduced into England by P. Miller in the last century, but it is not now, we believe, in cultivation. The flowers are described as deliciously sweet-scented, and appear in March and April.

Daniell in Pharm. Journ., ser. 2, iv (1862), p. 145; Müll., Arg., l. c., p. 516; Grisebach, Fl. W. Ind. (1864), p. 39.*

Official Part and Names.—Cascarillæ Cortex. The bark (B. P.)—The bark (*Cascarillæ Cortex*) (I. P.)—Cascarilla. The bark (U. S. P.)

Commerce.—Cascarilla bark is imported from Nassau, the principal town in New Providence, one of the Bahama Islands.

General Characters and Composition.—Cascarilla bark usually occurs in quills, which vary in length from one, to two, three, or more inches, and in diameter from the size of a common goose-

* Grisebach here recombines this shrub with *C. Sloanei*, J. J. Benn. (*C. Eluteria*, Swartz, *C. glabellus*, Müll. Arg.), a native of Jamaica, figured very badly in Woodville, t. 223, fig. 1, and beautifully in Hayne, xiv, t. 1, Daniell, 2nd plate, and B. & S., t. 28, b. But the species seem so thoroughly distinct, and were so clearly distinguished by Bennett, that this retrograde step is little likely to be followed.

quill to that of the little finger. The external suberous coat is easily separated from the inner coats, and is more or less covered with a silvery-white minute lichen (*Verrucaria albissima*, Ach.), the perithecium of which is seen in the form of black specks. The colour of the suberous coat when not coated with lichens is dull brown, which is also the colour of the bark generally. The bark is moderately hard, has a compact texture, and breaks readily with a short resinous fracture. The taste is warm and nauseously bitter, and its odour agreeable and aromatic, more especially when burned: hence by this character cascarilla is readily distinguished from other barks.

The principal constituents of cascarilla bark are a *volatile oil*, *resin*, and a bitter crystalline principle, first isolated by Duval, and named by him *Cascarillin*.

Medical Properties and Uses.—Cascarilla bark is aromatic, bitter, and tonic. Formerly it was much used, especially in Germany, as a substitute for cinchona; but although it is very far inferior to this bark as a tonic and febrifuge, it is a useful tonic in convalescence after fevers. In this country it is principally employed in atonic dyspepsia, in chronic bronchial affections to check excessive secretion of mucus, and in chronic diarrhœa and dysentery. The agreeable musky odour which it produces when burned also renders it a useful ingredient in fumigating pastilles, for which purpose it is frequently used. For the same reason it is sometimes mixed in small quantities with tobacco, in order to render it more agreeable for smoking. It is said, when thus used, to cause giddiness and intoxication, but this is scarcely probable.

Per. Mat. Med., vol. ii, part 1, p. 412; Pharmacographia, p. 506; U. S. Disp., by W. and B., p. 234; Journ. de Pharm., 3rd ser. viii, 96.

DESCRIPTION OF PLATE.

Drawn from specimens collected in Providence Island, Bahamas, by Dr. W. F. Daniell in 1858 (Brit. Museum). 1. Small branch, with leaves and several racemes of fruit and flowers. 2. Male flower. 3. The same in vertical section. 4. Female flower. 5. Vertical section of the same. 6 and 7. Fruit. 8. Transverse section of the same. 9 and 10. Seed, inner surface. 11. Scale from leaf. (2—5, 7, 8, and 10 enlarged. 11 greatly magnified.)

D Blair ad nat del et lith.

M & N Hanhart imp

CROTON TIGLIUM, *Linn.*

N. Ord. EUPHORBIACEÆ.

Tribe *Crotoneæ*.

Genus **Croton**, *Linn.*

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239. Croton (*Eu-croton*) Tiglium,* *Linn., Sp. Plant., ed.* i, *p.* 1004 (1753).

Jamalgota. Jepāl. Purging Croton.

Syn.—Tiglium officinale, *Klotzsch.* Croton Jamalgota, *F. Hamilton.*

Figures.—Nees, t. 138; Woodville, vol. v; Hayne, xiv, t. 3; Berg & Sch., t. 17 e; [Steph. & Ch., t. 4, "taken from a drawing in the Medico-Botanical Society in London," can scarcely be this species]; Burm., Thes. Zeyl., t. 90; Rheede, Malab., pt. ii, t. 33; Marchand in Adansonia, i, t. 9, 10; Baillon, Hist. Pl., v, f. 196—202.

Description.—A small tree, 15—20 feet high; trunk rather crooked, with smooth bark; branches slender, smooth, terete; bark pale whitish-brown, marked with scars of the fallen leaves. Leaves alternate, on stalks nearly half as long as the blade; blade about $4\frac{1}{2}$ inches long by 2 inches wide when full grown, thin, glabrous, ovate, attenuate at the apex, faintly and rather distantly serrate, pale bright green, veins prominent beneath, petiole breaking up immediately on entering the leaf into 5 veins, the two lateral faint, the two intermediate well marked, giving with the mid-rib a triple-nerved aspect to the leaf; on either side of base of the blade and connected with the petiole is a prominent sessile gland; stipules minute, filiform, deciduous; the young leaves and buds with scattered stellate hairs. Flowers in lax, terminal, erect racemes, unisexual; the male at the upper part of the raceme, the female less numerous at the lower part; pedicels longer than the flowers; bracts minute. Male flower: calyx of 5 spreading, broadly triangular, blunt sepals, with valvate æstivation; petals 5, inserted on the flat receptacle, alternate with and reflexed between the sepals, oblong-linear, blunt, set with rather

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* The seeds were called *Grana Tiglii* or *Grana Tilli* by the pharmacists of the 17th century; but we do not know the origin of these names.

long white hairs above, glabrous beneath, pale green; a prominent roundish yellow gland stands within each sepal, alternating with the petals; stamens 14—20, as long as the petals, one opposite each petal and sepal, the remainder irregularly dispersed over the receptacle, which is covered with short white hairs, anthers small, broad, innate, cells semilunar. Female flower; calyx deeply 5-partite, divisions ovate, acute, spreading or reflexed, set with few or more numerous stellate hairs and with a small rounded prominence in the angle between each; glands 5, blunt, prominent, opposite the sep., as in the male flowers; petals round; ovary sessile, thickly covered with stellate hairs, 3-celled, with a single pendulous ovule in each; styles 3, deeply bifid. Fruit about the size of a hazel-nut, slightly inflated, pale, smooth, brownish-yellow, capsular, 3-celled, with a single large seed in each cell; dehiscing septicidally into 3 cocci, and afterwards loculicidally. Seeds nearly $\frac{1}{2}$ an inch long by about $\frac{2}{5}$ths wide, ovoid, rounded on the back, marked on the ventral surface by a fine raised raphe; testa thin, brittle, light brown, black within; embryo with large foliaceous cotyledons, lying in the centre of the oily endosperm.

Habitat.—The croton oil plant is common throughout the Indian Peninsula, both wild and cultivated; it also grows in Ceylon, Borneo, and the Philippines, and as an introduced tree in Mauritius and Japan. It was first cultivated in this country in 1798, and is now to be seen in many botanic gardens, though it rarely flowers.

Marchand in Adansonia, i, p. 232; Müll. Arg., l. c., p. 600; Roxb., Fl. Ind., iii, p. 682; F. Hamilton in Trans. Linn. Soc., vol. xiv, p. 258.

Official Parts and Names.—Oleum Crotonis. The oil expressed from the seeds (B. P.)—The seeds (*Crotonis semina*) (I. P.)—Oleum Tiglii. The fixed oil obtained from the seed (U. S. P.)

General Characters and Composition of Croton Seeds.—The croton seeds of commerce are about the size of coffee beans, oval in shape and imperfectly quadrangular in form. The testa is of a dark cinnamon-brown colour on the surface, but when scraped it

presents a black appearance. This testa is brittle, and encloses a pale-coloured, delicate seed-coat, within which is the yellowish-oily albumen enclosing the embryo which has been already described. The seeds have no odour, and at first they have but a mildly oleaginous taste, but soon become persistently acrid and burning.

The principal constituents of croton seeds are a *fatty fixed oil* (see *Characters of Croton Oil*), *tiglinic acid*, *crotonic* or *quartenylic acid*, and *crotonol*. The latter is asserted by Schlippe, who has alone isolated it, to be the drastic principle of croton oil. The purgative principle has not been isolated. Tuson has indicated the presence of an alkaloid in croton seeds analogous to *cascarillin* from cascarilla bark, but his experiments require confirmation.

General Characters of Croton Oil.—Two varieties of croton oil are known in this country; one which is imported from India, and another, the one now almost generally in use, is expressed here from croton seeds which are chiefly imported from Cochin or Bombay. In India, in order to obtain the oil, the seeds are first subjected to slight torrefaction, by which the shell is more easily separated, and the kernel or nucleus is then submitted to pressure. In this country the commercial seeds, after having their shells removed, are submitted to pressure. The kernels yield from 50 to 60 per cent. of oil. Croton oil has a fluorescent appearance, more especially the English pressed oil, a viscid consistence, which is increased by age, a faint, peculiar, somewhat rancid, disagreeable odour, and an oily, acrid taste. The colour of the two varieties varies, that of the East Indian croton oil being pale yellow, and the English oil varying from brownish yellow to dark reddish brown like the deepest coloured sherry. Both kinds are soluble in ether and oil of turpentine, but they vary in their relations to alcohol—that of English oil being entirely soluble, while the Indian oil forms an opaque mixture with alcohol, which becomes clear if heat be applied, but the oil separates again by standing. Croton oil essentially consists of the fatty fixed oil mixed with the other constituents of the seeds.

Medical Properties and Uses.—Croton seeds when applied externally act as a powerful local irritant, and when given internally, in doses of a grain, as a very active drastic purgative. From their poisonous character when given in over doses they are not now used in this country. It is said, however, that in India, where the seeds are sometimes known under the name of *Jamalgata pills*, they have been used with great success in amenorrhœa; and Professor Erasmus Wilson speaks highly of a diluted tincture of croton seeds as a stimulant application in certain cutaneous affections, more especially in eczema, lichen, ichthyosis, and erythema.

Croton oil when rubbed on the skin acts as a rubefacient and counter-irritant, and when administered internally it operates as a powerful hydragogue cathartic. It is a most useful, and frequently a very valuable cathartic in any case in which it is desired to act speedily and powerfully on the bowels, as in obstinate constipation, in dropsy, in apoplexy, in paralysis, in torpid conditions of the intestinal canal, &c; and also in cases where the patient cannot or will not swallow, when it may be dropped on the tongue, as in some affections of the throat, mania, &c. The official liniments of the British and Indian pharmacopœias when rubbed on the skin produce redness and a pustular eruption. They act as useful stimulants when thus applied in chronic rheumatism, neuralgia, glandular and other indolent swellings, and in chronic bronchitis and other pulmonary affections.

U. S. Disp., by W. and B., p. 624; Pharmacographia, p. 508; Per. Mat. Med., vol. ii, part i, p. 409; Ph. Jl., vol. iv, 2nd series, 382 and 387; Per. Mat. Med., by B. and R., p. 525; Wilson, Diseases of the Skin, p. 177.

DESCRIPTION OF PLATE.

Drawn from a specimen kindly sent by Dr. D. Moore from Glasnevin Garden, Dublin, where it flowered in September, 1874; the fruit added from examples in the Museum of the Pharmaceutical Society of Great Britain. 1. A flowering branch. 2. Male flower. 3. Section of the same. 4. A female flower. 5. Section of same. 6. Fruit. 7. Transverse section of the same. 8. Seed, ventral surface. 9. Vertical section of the same. 10. A stellate hair from the inflorescence. (2—5 enlarged. 10 much magnified.)

D.Blair ad nat.del.et lith.

M&N Hanhart imp.

EUPHORBIA RESINIFERA, *Berg*.

N. Ord. EUPHORBIACEÆ.

Tribe *Euphorbieæ*.

Genus Euphorbia,* *Linn.* Baill., Hist. Pl., v, p. 105; Boissier, in DC. Prod., xv, pt. 2, pp. 7–187. Species about 700, natives of all parts of the world.

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240. Euphorbia resinifera, *Berg in Berg and Schmidt, Darst. und Beschr. Offic. Gewachse, t.* 34 *d* (1863).

Dergmuse, Darkmous (Morocco).

Figures.—Jackson, Account of Morocco, t. 6, left-hand figure (whole plant); Berg & Sch., t. 34 d, fig. M—X (inflorescence and fruit).

Description.—A leafless perennial plant somewhat resembling a Cactus. Stem 4 or more feet high, with a very short trunk, covered with greyish bark and becoming woody with age, then much branched, branches long, stiff, spreading and curved like those of a candelabrum, fleshy, quadrangular (rarely triangular), with concave faces about 1 inch wide, and blunt angles along which are placed at short intervals triangular brown scaly plates (scutella), each bearing two short, sharp, spreading spines (altered stipules) about ¼ inch long. Leaves quite absent, represented by a minute tubercle fused with the scale. Flowers unisexual, monœcious, very small and simple, mixed with numerous fimbriated bractlets, either all male, or with a single female in the centre, collected into small few-flowered heads surrounded by a cup-shaped, perianth-like involucre provided at its mouth with 5 large, spreading, very broadly wedge-shaped golden-yellow petaloid "glands"; heads arranged in clusters of 3, coming off from a little above the space between the stipular spines, the middle one nearly sessile, the lateral ones on short thick stalks, with a little bract at the base. Male flowers:—Achlamydeous, consisting of a single stamen with a very short filament, jointed on to the summit of a filiform pedicel. Female flowers:—Perianth very small, 3-fid, at the summit of a long thick pedicel, pistil large,

* Ευφόρβιον, *euphorbium*, was the name of the drug in classical authors.

deeply 3-lobed, smooth. Fruit a small capsule about $\frac{3}{8}$ inch wide, on a long stalk projecting beyond the involucre, and strongly curved downward, very deeply 3-lobed, lobes rounded, depressed, laterally compressed and strongly keeled on the back, smooth; pericarp hard, thick. Seed solitary in each cell, roundish ovoid, faintly papillose, without a strophiole; embryo straight, with a superior radicle in the axis of copious endosperm.

The above description is chiefly taken from Berg and Cosson. We have seen no specimen of the flowers or fruit.

Habitat. — This remarkable succulent species of *Euphorbia* grows only on the slopes of the Great Atlas range in the interior of Morocco, chiefly to the south-east of the city of the same name. It was first described by Jackson, whose figure was published in 1809; he says it is "probably the *Euphorbium officinalis* of Linnæus," but does not give any definite specific name. Dr. (now Sir Joseph) Hooker and Mr. Ball met with it in the year 1871 in the province of Dimineh, and it has been observed by several other travellers.

The first observer appears to have confounded with this another Cactoid species of which he figures a fragment on the same plate (right-hand figure). This, which has 9- or 10-angled branches, grows chiefly further west nearer the coast, and is the *E. Beaumieriana*, Hook. f. & Coss. Jackson's figures were long thought to probably represent *E. Canariensis*, L., and that name has been therefore given as the source of the drug; Berg, however, by a careful comparison of that species with the fragments of the plant mixed with the imported drug, was able to detect abundant differences, and to found the present species, *E. resinifera*.

Living plants were sent to Kew in 1870 from the mountains of Netifa, east of Morocco, where they were collected by Mr. J. W. Grace; these plants have not yet flowered, but a specimen sent from the district of Misfioua, and cultivated in the Paris garden, has done so, and confirmed Berg's characters.

As to the *E. officinarum* of Linnæus, though it was, of course, intended to apply to the official species, yet, as it was founded on

various figures and descriptions (none of them the present plant) apparently representing several species, it is not possible to determine its true application. The localities given by Linnæus are Ethiopia and the warmer parts of Africa. *E. officinarum* of Boissier's monograph (l. c., p. 84) is partly the *E. Beaumieriana* above noticed.

Euphorbia is one of the largest known genera; the floral structure of all the species is very similar, but there is a marvellous variety in their habit and appearance. It should be mentioned that there is great difference of opinion among botanists as to the structure above described as an involucre. Though this is the opinion generally held, others consider it to be a true perianth, and what is here described as an inflorescence to be a single flower.

The section *Diacanthium*, to which our plant belongs, contains between thirty and forty species, all of the old world, and mostly African; many are very imperfectly known.

J. G. Jackson, Account of Morocco, ed. 2, p. 134 (1811); Berg and Schmidt, Darst. and Beschr. Off. Gew., 34 d (1863); Cosson, in Bull. Soc. Bot. Belgique, x, p. 5 (1871), and Bull. Soc. Bot. France, xxi, p. 163 (1874); Flück. & Hanb., Pharmacogr., p. 502.

Part Used and Name.—EUPHORBIUM; the concrete resinous juice, or gum-resin, obtained by incision in the green fleshy branches of the plant. It is not now official in the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States; but it was formerly recognised in the London, Edinburgh, and Dublin Pharmacopœias.

Extraction, Collection, and Commerce.—Euphorbium is procured in the districts lying to the east and south-east of the city of Morocco, as follows:—Incisions are made into the green fleshy branches of the plant, when an abundance of milky juice exudes, which is so acrid that it excoriates the fingers when applied to them. This exuded juice hardens by exposure to the sun as it flows down the stems, which it encrusts, and some of it also drops

off; it is collected in the month of September, and forms the euphorbium of commerce. So great is the acridity of the exudation, says Mr. Jackson, that the people who collect it, are obliged to tie a cloth over their mouth and nostrils to prevent the small dusty particles from annoying them, as they produce incessant sneezing. The drug is exported from Mogadore; but little is consumed in this country.

General Characters and Composition.—Euphorbium, or *Gum Euphorbium* as it is commonly, although incorrectly, termed, consists of irregular, dull yellow or yellowish-brown, waxy-looking tears or pieces, the largest of which are rarely more than an inch across, among which we commonly find mixed, portions of the angular spiny stems of the plant from which they have been derived. The tears are usually pierced with one or two holes, and encrust a tuft of spines, or a flower-stalk; or sometimes they are hollow. They are brittle and translucent; and almost odourless, except when heated, when they are slightly aromatic; but their dust when applied to the olfactory membrane acts as a powerful sternutatory. Their taste is at first slight, but afterwards acrid and burning.

Euphorbium has been frequently analysed, and within the last few years both by Flückiger and Buchheim. The analysis of Flückiger show the drug to contain in 100 parts, 38 of *amorphous resin;* 22 of a substance which was first made known by him, and which he termed *euphorbon;* 18 of *mucilage;* 12 of *malates,* chiefly of calcium and sodium; and 10 of *mineral constituents.* It is to the amorphous resin, which is soluble in alcohol, that euphorbium owes its intense acridity. The substance termed *euphorbon* is soluble in ether or chloroform, only sparingly soluble in cold, but readily in boiling alcohol, and quite insoluble in water. Euphorbon forms colourless crystals, which when pure are without taste or odour. Flückiger states that euphorbon is allied to *lactucerin,* which is referred to by us under the head of Lactucarium when treating of "Lactuca sativa."

The more recent analysis of Buchheim also shows that the activity of euphorbium is dependent upon its acrid resin only, and

not upon euphorbon, as had been suggested by Husemann. The acrid resin seems also, by the analysis of Buchheim, to consist of two substances, and he regards it as the *anhydride of an acid*, which he has called *euphorbic acid*.

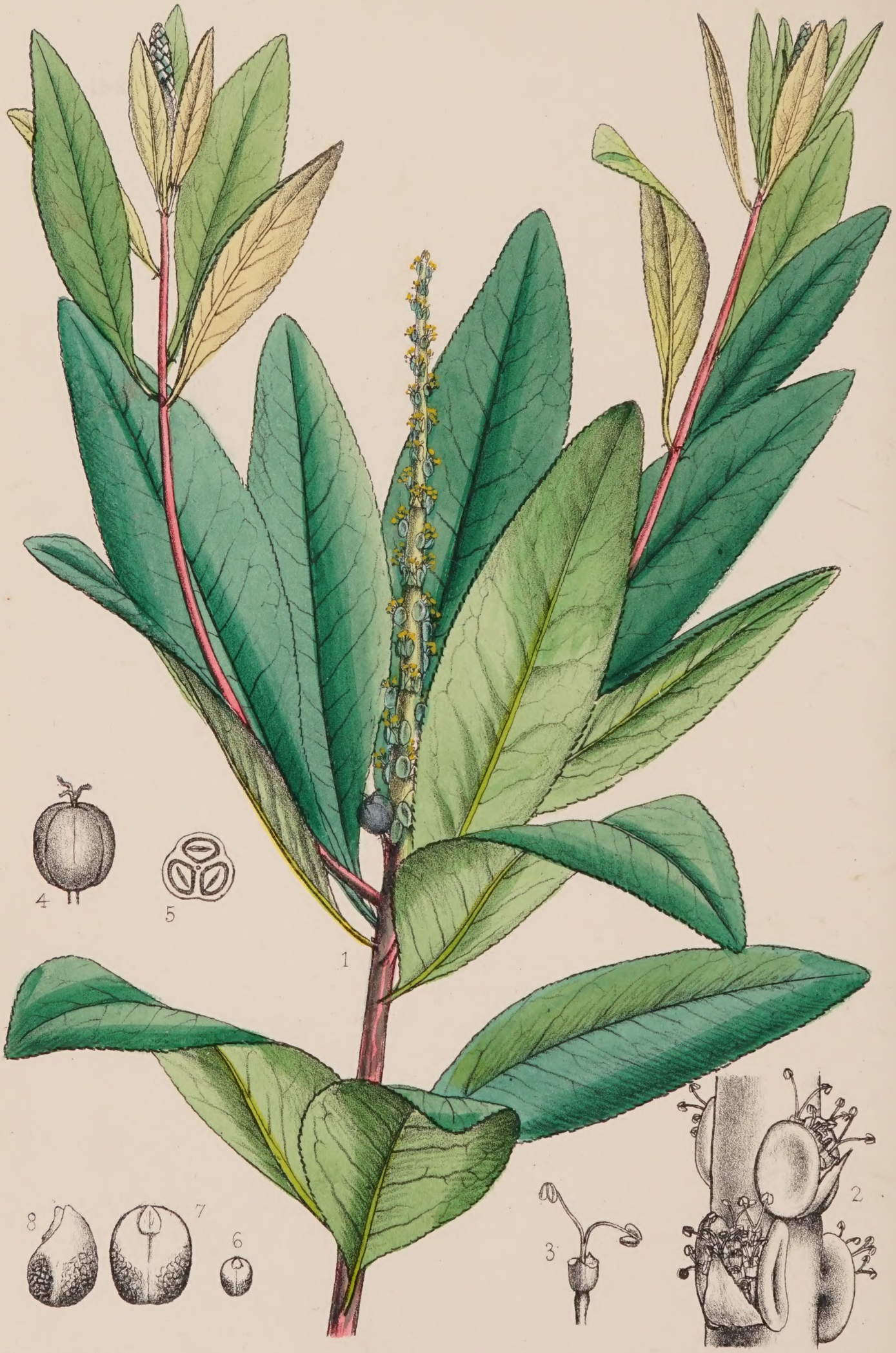
Medical Properties and Uses.—It was formerly in use as an emetic and purgative; but its violent and dangerous action have now led to its disuse as an internal remedy. It is sometimes employed as an errhine in amaurosis, deafness, and other obstinate affections of the brain; but its local action is so violent that we can only use it when largely diluted with some mild powder, as starch or flour. As a rubefacient it may be employed in the form of a plaster when mixed with Burgundy pitch or resin, in chronic affections of the joints. As a vesicant it is also sometimes used on the Continent; and in this country and elsewhere it is occasionally employed in veterinary practice as a vesicating agent.

The authors of Pharmacographia say that they have been told "that it is now in some demand as an ingredient of a paint for the preservation of ships' bottoms."

Per. Mat. Med., vol. ii, pt. 1, p. 400; Pharmacographia, p. 502; U. S. Disp., by W. & B., p. 1592; Jackson's Morocco, 3rd edit., p. 134; Pharm. Journ., ser. 3, vol. ii, p. 1049; Flückiger, in Wittstein's Vieteljahresschrift für prakt. Pharmacie, vol. xvii (1868), p. 82, and Amer. Journ. Pharm., Sept., 1868, p. 393; Buchheim, in Vieteljahresschrift Ph., 1873, No. 3, p. 325, and Proc. Amer. Pharm. Assoc., vol. xxii, p. 159.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Economic House at Kew Gardens; the details added from Berg and Schmidt. 1. Upper portion of a young plant. 2. Summit of a branch with flower-heads. 3. A cluster of three flower-heads. 4. A male flower-head. 5. Vertical section of the same. 6. A monœcious flower-head. 7. A capsule. 8. The same seen from above. 9. The same dehiscent. 10. A single valve. 11, 12. Seeds. (3–6, 8–12 enlarged.)



D.Blair ad sicc del et lith.

M&N.Hanhart imp

STILLINGIA SYLVATICA, *Linn.*

N. Ord. Euphorbiaceæ.

Tribe *Hippomaneæ*.

Genus **Stillingia**,* *Garden, in Linn. Mant.* Müll. Arg., l. c., pp. 1155—1162; Baill., Hist. Pl., v, p. 135. Species 12, natives of tropical regions in both hemispheres.

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241. Stillingia sylvatica, *Linn., Mant., p.* 126 (1767).

Queen's Delight.

Syn.—Sapium sylvaticum, *Torrey.*

Not previously figured.

Description.—Stems numerous from a large woody root, erect or ascending, 1—3 feet high, herbaceous or slightly woody below, simple, umbellately branched above, smooth, terete, with a milky juice. Leaves numerous, alternate, irregularly scattered or crowded, nearly sessile, variable in form from narrow-lanceolate to broad-oval, tapering at base, closely crenate-serrate, with a gland in each crenature, rather thick; stipules minute, setaceous, deeply divided, early deciduous. Inflorescence arranged upon a thick, terminal, compressed, yellowish axis, afterwards exceeded by the two or more branches which are given off from below its base, 2—4 inches long. Flowers unisexual; the male flowers in dense clusters of 8 or 10, arranged round the spike for nearly its whole length, each cluster in the axil of a thin, broad, acute scale with a scarious margin, and provided on either side with a large, circular, shallow, cup-shaped gland attached by its centre; the female flowers very few (or none) at the base of the spike, solitary, in the axil of similar bracts to those of the male clusters. Male flowers shortly stalked, consisting of 2 stamens on long filaments connected for half their length and surrounded by (at first enclosed in) a membranous, cup-shaped, two-cleft calyx.

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* Named after Dr. Benjamin Stillingfleet, an English botanist of the 18th century, author of 'Miscellaneous Tracts relating to Natural History, &c.' 1759.

Female flowers; calyx 3-lobed; style slender, articulated below, with 3 spreading branches. Capsule roundish, slightly rough, greenish brown, 3-celled, with a single seed in each cell, separating into 3 cocci, which open down their dorsal suture. Seeds nearly globular, silvery white, roughish, with a well-marked caruncle.

Habitat.—Common in dry sandy soil in the Southern United States of America from Virginia to Florida and westward to Texas. It is an insignificant weed-like plant, and is not in cultivation in English gardens.

Müll. Arg., l. c., p. 1158; A. Gray, Man. Bot. U. S., p. 391; Chapman, Fl. S. States, p. 404.

Official Part and Name.—Stillingia. *Queen's Root.* The root of Stillingia sylvatica (U. S. P.)—Not official in either the British Pharmacopœia or the Pharmacopœia of India.

General Characters and Composition.—Stillingia has been fully described by Dr. Wood in the *United States Dispensatory*. It occurs in long cylindrical pieces, from a third of an inch to more than an inch thick, wrinkled from drying, of a dirty yellowish-brown colour externally, and, when cut across, exhibiting an interior soft, yellowish, ligneous portion, surrounded by a pinkish-coloured bark. The odour is slight, peculiar, and somewhat oleaginous, but in the recent root is said by Dr. Frost to be strong and acrimonious. The taste is bitterish and pungent, leaving an impression of disagreeable acrimony in the mouth and fauces. Nothing certain is known of its composition, but the active principle is said to be volatile, and the root consequently loses much of its activity when kept. Its virtues are imparted to both water and alcohol.

Medical Properties and Uses.—Stillingia is emetic, cathartic, and alterative. It is regarded by Dr. T. Young Symons, of the United States, who first introduced it to the notice of the profession, as a valuable alterative in syphilis and other affections where mercury is commonly employed. Other physicians have also spoken highly in favour of its use, and from their testimony its value is regarded in the United States of America, as established

in secondary syphilis, scrofula, various cutaneous diseases, chronic diseases of the liver, and other complaints ordinarily benefited by alterative medicines. It may be either given alone or combined with sarsaparilla and other alteratives. So far as we know, this remedy has not been used in this country, but from the testimony given of its value by medical practitioners in the United States it is well deserving of a trial.

United States Dispensatory, by Wood and Bache, p. 838.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Brit. Mus. collected by Dr. Garden in Carolina; the fruit added from a Texan specimen collected by Lindheimer, in the same herbarium.

1. Upper part of a flowering stem.
2. Portion of spike showing male clusters.
3. A male flower.
4. Fruit.
5. Transverse section of same.
6, 7. A seed.
8. The same seen from side.

(2, 3, 7, 8 enlarged.)

D.Blair ad sicc. del.et lith.

M&N.Hanhart im

PIPER ANGUSTIFOLIUM, *R&P*

N. Ord. PIPERACEÆ. Lindl., Veg. K., p. 515; Baill., Hist. Pl., iii; Le Maout & Dec., p. 728.

Genus Piper,* *Linn.* Baill., Hist. Pl., iii, p. 469; DC. Prod., xvi, pt. i, pp. 240—388. A very large genus. About 600 species are known, natives of tropical regions in both worlds.

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242. Piper angustifolium, *Ruiz & Pavon, Fl. Peruv.*, I, *p.* 38 (1798).

Matico.

Syn.—P. granulosum, *R. & P.* P. elongatum, *Vahl.* Artanthe elongata, *Miquel.* Steffensia elongata, *Kunth.*

Figures.—Ruiz & Pav., Fl. Peruv., i, tt. 57 a (cop. in Pharm. Journ., iii, p. 472), and 64 b (*P. granulosum*); Miquel, in Fl. Brasil., Piperaceæ, t. 14.

Description.—A shrub about 8 feet high, with numerous cylindrical or bluntly quadrangular slender branches, the older ones smooth, the younger ones densely covered with short, soft or rough hairs, all considerably thickened at the joints. Leaves alternate, very shortly stalked, 5—7 inches long, oblong-lanceolate, with a cordate often unsymmetrical base and an acuminate blunt apex, entire, rather stiff and thick, with the whole surface traversed between the secondary nerves by a small tessellated reticulation of veins, sunk on the upper surface, prominent beneath, glabrous above when mature, more or less densely covered with unbranched, tapering hairs beneath, which are especially abundant on the sides of the prominent veins, bright green. Flowers minute, hermaphrodite, very densely packed in close rings round a strong slender axis so as to form a solid, cylindrical, yellow, spadix-like spike 4—7 inches in length, containing innumerable flowers, each one of which has beneath it a scale-like bract with a filiform claw expanded at the end into a circular or triangular peltate scale strongly fringed all round and thickened in the centre,

* *Piper*, in Greek πέπερι, the classical names for the spice; originally from the Sanskrit *pippali.*

overlapping the summit of the flower; the spikes are bluntish, very shortly stalked, and come off one at a node on the opposite side to the leaf. Perianth entirely absent. Stamens 2—4, hypogynous; filaments slender; anthers roundish, 2-celled, didymous, readily detached; ovary top-shaped, smooth, as long as the stamens, one-celled, with a single erect orthotropous ovule; style short, terminal; stigmas 3, spreading. Fruit very small, dry, indehiscent, about the size of poppy-seed, ovoid, somewhat compressed, faintly punctate in lines, hard, black. Seed completely filling the fruit; embryo minute, in a cavity excavated at the summit of the copious mealy endosperm.

Habitat.—This plant grows in moist forest-land over a considerable range of tropical America. It was first known in Peru, but has since been collected in Mexico, Panama, Venezuela, New Grenada, Columbia, Ecuador, Bolivia, and Brazil, and also in the island of Cuba. It is cultivated occasionally in some of these countries.

There is considerable difference in the foliage, both in the width of the leaves and in the amount of rugosity of the upper surface and hairiness of the lower; the amount and nature of the hairiness of the branches is also variable. Two varieties are distinguished in the "Prodromus:" *cordulatum* with cordate-ovate leaves, and *Ossanum* with the leaf-bases narrowed.

This plant may be seen in the stoves of botanical gardens in this country, but does not flower there.

The late Prof. Miquel divided the Linnean genus *Piper* into a number of smaller genera, but Casimir De Candolle, in his more recent work, has again united them under the old and comprehensive one. *Artanthe,* in which the present species was placed by Miquel, is characterised by its hermaphrodite flowers, peltate bracts, and the absence of a style; it contains a large number of species, all American.

Cas. DC., in DC. Prod., xvi, pt. i, p. 285; Ruiz & Pavon, Fl. Peruv., i, p. 38; Miquel, Syst. Piper., p. 434.

Official Part and Names.—Maticæ Folia; the dried leaves of Artanthe elongata, *Miquel* (B. P.). The dried leaves (I. P.). The leaves (U. S. P.).

General Characters and Composition.—Matico leaves, or Matico as the drug is commonly called, are usually forwarded to this country and elsewhere, packed in bales and serons, by way of Panama. As thus imported, Matico consists of the dried leaves, stalks, and spikes of flowers and fruits, more or less compressed together into a coherent brittle mass, which has a greenish-yellow colour. The botanical characters of the leaves and other parts have been fully described above; those of the leaves are briefly given in the British Pharmacopœia, as follows:—"From two to eight inches long, veined and tessellated on the upper surface, downy beneath, with an aromatic slightly astringent warm taste, and an agreeable aromatic odour.

The principal constituents of matico are a *volatile oil*, a *resin*, a crystallizable acid, called *artanthic acid*, and a little *tannic acid*. It was formerly supposed to contain a peculiar bitter principle, which was termed *maticin;* but more recent experiments have shown that no such substance, nor any analogous principle to the piperin or cubebin of the other official species of *Piper*, is contained in matico. The volatile oil is described as of a light green colour, a thickish consistence, feebly dextrogyre, and depositing crystals of a kind of camphor in the winter months. The presence of tannic acid is indicated by the dark greenish-brown colour which the infusion assumes on the addition to it of perchloride of iron; but the infusion undergoes no change on the addition of solution of gelatine, tartarated antimony, or corrosive sublimate, hence the proportion of tannic acid is but small. According to Mr. Snell, the medicinal properties of matico are due to the volatile oil and resin; it is also probable that the tannic acid has some effect.

Substitutes.—Under the name of *Matico*, the leaves of several plants are employed by the inhabitants of Central and South America, for arresting both external and internal hæmorrhages, and for other purposes. The discovery of the styptic property of this

drug is said to have been made by a Spanish soldier named Matico, (hence the name, which is not a native one), who when desperately wounded dragged himself into the shade of the plants near him, and in his agony plucked some of their leaves, and applied them accidentally to his wound, when to his great surprise and delight he found in a short time that the bleeding was arrested, and the wound soon healed. From this circumstance Matico has also received the Spanish names of 'yerba soldado' and 'palo del soldado,' signifying 'Soldier's herb' and 'Soldier's tree.' Three plants have been especially mentioned by authors as having received the name of Matico or Soldier's herb, namely, the plant now being described, which is alone official; *Eupatorium glutinosum,* Kunth; and *Waltheria glomerata,* Presl.

In 1863, just before the issue of the British Pharmacopœia, matico was very scarce in this country; and the leaves and spikes of fruit of another plant were therefore imported from Central America, and sold under the same name. This kind of matico was ascertained by one of us to be derived from *Artanthe adunca,* Miquel, (*Piper aduncum,* L.). A similar kind of matico is also still occasionally imported. It may be at once distinguished from the official matico, by being in a less compressed state, by the upper surface of the leaves not being so rough and tessellated, and by the almost entire absence of pubescence on their under surface. The chemical characters of the two kinds appear to be closely analogous; and therefore as an internal remedy, this matico is probably equally efficacious as that of the official kind.

Medical Properties and Uses.—Matico is regarded as a mild aromatic tonic and stimulant, acting more especially like cubebs and pepper on the genito-urinary mucous membranes and rectum. It is also stated to be a valuable internal styptic or hæmostatic; and in Peru, it is likewise regarded as an aphrodisiac. It has been employed in leucorrhœa, menorrhagia, catarrh of the bladder, atonic diarrhœa, dysentery, epistaxis, hæmoptysis, hæmatemesis, hæmaturia, and other affections; but it is not much esteemed as an internal remedy by practitioners in this country. Dr. John Harley says "a cup of tea is much more potent." Topically

applied, however, to superficial wounds, leech-bites, or after the extraction of teeth, &c., it is most effectual in arresting hæmorrhage; for this purpose the under surface of the leaf or the powder may be applied to the bleeding parts, but the former is the best form of application in such cases.

Per. Mat. Med., by B. & R., p. 521; Pharmacographia, p. 531; U. S. Disp., by W. & B., p. 555; Guibourt, Hist. des Drogues (1869), vol. ii, p. 278; Royle's Mat. Med., by J. Harley, p. 436; Jeffery's Remarks on Matico, 3rd ed. (1845); Morson, in Pharm. Journ., vol. iii, ser. i, p. 472; Hodges, Proc. Chem. Soc., vol. ii (1844), p. 123, and Pharm. Journ., vol. iv, ser. i, p. 286; Stell, in Amer. Journ. of Pharm., Sept., 1858, p. 392; Bentley, in Pharm. Journ., vol. v, ser. ii, pp. 290—296; Pocklington, in Pharm. Journ., vol. v, ser. iii, p. 301; Gardeners' Chronicle, vol. ii, n. s., p. 679.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum collected by Pavon in Peru.

1. A branch with leaves and spikes of flowers.
2. Several flowers with their bracts *in situ*.
3. A flower.
4. A bract.
5. A fruit.
6. A section of the same.

(2–6 enlarged.)

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N. Ord. PIPERACEÆ.

Genus Piper, *Linn.*

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243. Piper Cubeba,* *Linn. fil., Supplem. Plant., p.* 90 (1781).

Cubebs.

Syn.—Cubeba officinalis, *Miquel.* P. caudatum, *Houtt.* non *Vahl.*

Figures.—Steph. & Ch., t. 175, cop. in Woodville, v, 5; Hayne, xiv, t. 8; Berg & Sch., t. 29 a; Baill., Hist. Pl., iii, fig. 508; Miquel, Comment. Phytogr., tt. 1, 2; Descourt., Fl. Antilles, vi, t. 429.

Description.—A climbing shrub with cylindrical, smooth, zigzag, striate stems, somewhat thickened at the nodes. Leaves alternate, on short stout petioles, blade about 6 inches long, lanceolate or oval-oblong, tapering to the acute apex, usually somewhat unequal at the base, quite entire, slightly wavy, glabrous on both surfaces, somewhat coriaceous, deep green, rather paler and with prominent veins beneath. Flowers unisexual, dicœcious, minute, sessile, each with a bract at the base, densely crowded in small, cylindrical, stalked, solid spikes coming off opposite the leaves; the male spikes slender, tapering, shortly stalked, about an inch long, the female shorter, blunt, thick and fleshy, on longer stalks; bracts of the male flowers crowded, imbricate, thin, rhomboidal, subacute, of the female flowers peltate, nearly circular, slightly hairy, fleshy, with a short stalk. Male flower: perianth absent; stamens 2 (or 3 ?), anthers short, ovate, 2-celled. Female flowers; no perianth, ovary sunk in the substance of the spadix, globular, with a single erect ovule, style very short, stigmas 3 or 4, short, recurved, papillose. Fruit globular, smooth, about $\frac{1}{4}$ inch long, with a blunt apiculus and tapering below into a stalk-like base, which is a little longer than the round extremity, projecting horizontally from the axis and together forming a lax

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* *Cubeba*, κομβέβα of Actuarius, a name dating from about the 10th century, doubtless of Arabic origin.

raceme (many of the ovaries becoming abortive) about 2 inches long. Seed as in the last.

Habitat.—This pepper is found wild in Java, Sumatra, and Borneo, and is cultivated in the two former islands, being grown chiefly in coffee plantations. It is also cultivated in some of the West Indian Islands. The native cubebs of Mauritius is *P. borbonense,* Cas. DC., and that of West Tropical Africa *P. Clusii,* Cas. DC. (*P. Afzelii,* Lindl.), both close allies of *P. Cubeba,* which, however, does not occur in either of those countries. Cubebs is cultivated in many of our botanical gardens.

We have not had the opportunity of examining male plants; the leaves of these are said to be narrower and with the lower veins fainter than in the female. Miquel's genus *Cubeba* is characterised by being dicœcious, the male flowers with 2 to 5 stamens and the female with a sessile ovary, the fruit contracted below into a false pedicel.

P. caninum, Dietr., affords fruits which are distinguished from true cubebs by their smaller size, more ovoid form and somewhat shorter stalks; it is a native of Borneo and Java and is figured by Miquel in his Comm. Phytogr., t. 3.

Miquel, Comment. Phytograph., p. 10, and Fl. Ind.-Bat., i, pt. 2, p. 448; Cas. DC., in DC. Prod., xvi, pt. 1, p. 340; Lindl., Fl. Med., p. 313; Flück. & Hanb., Pharmacogr., p. 526.

Official Parts and Names.—1. Cubeba; the dried unripe fruit of Cubeba officinalis, *Miquel*: 2. Oleum Cubebæ; the oil distilled in Britain from Cubebs (B. P.). The dried unripe fruit (I. P.). Cubeba; the dried unripe fruit (U. S. P.).

1. Cubeba.—*Cultivation, Collection, and Commerce.*—The Cubeb plant is cultivated in Java and Sumatra either in ground specially reserved for the purpose, or more commonly in coffee plantations. The fruits are gathered when full grown, but before they are ripe, and then carefully dried. They are chiefly exported from Java to Singapore; and in 1872 the quantity shipped from thence to Great Britain was 1180 cwt., to the United States 1244 cwt., and to British India, 104 cwt.; but the quantities forwarded to different countries vary much in different years.

General Characters and Composition.—In size and form cubebs resemble black pepper, but they are readily distinguished from it by being furnished with a stalk, from which circumstance they have received the name of *tailed pepper.* They are spherical in form, and about the size generally of black pepper, or of a small pea; their colour is blackish or greyish-brown; and they are much wrinkled on the surface from the contraction of the fleshy portion of the pericarp in drying. The stalk is continuous with the wrinkled pericarp, and therefore, as already noticed, remains permanently attached in the cubebs of commerce; this stalk is commonly a little longer than the fruit itself, or rarely it is nearly twice as long. Within the shrivelled skin is a hard, brown, smooth shell; containing a solitary, whitish, smooth, oily seed, of a somewhat flattened globular form, when fully developed, but in commercial cubebs the seed is frequently much shrunken. Cubebs have a warm, camphoraceous, somewhat bitter and acrid taste; and a peculiar, very aromatic, and by no means disagreeable odour.

The most important constituents of cubebs are the *volatile oil* which is described below, *cubebin, resin,* and *cubebic acid. Cubebin* is an inodorous, tasteless, neutral, and inert substance, which crystallises in small needles or scales. It is insoluble in cold, but slightly so in hot water; it is soluble in about 30 parts of cold ether, and freely in boiling alcohol. The amount of cubebin has been variously estimated at from 0·40 to 2·5 per cent. There are two resinous substances, namely, an *acid resin,* termed *cubebic acid,* which exists in the proportion of about 1 per cent. in the drug; and a *neutral* or *indifferent resin,* which constitutes about 3 per cent. The activity of the drug is more generally supposed to reside essentially in the volatile oil; but others believe that the therapeutic action of cubebs is entirely due to the neutral resin and cubebic acid, as we have stated below in describing the medical properties and uses of oil of cubebs.

Medical Properties and Uses.—Cubebs have stimulant and diuretic properties. Their stimulant effects are especially manifested on the genito-urinary mucous membrane; they are a valuable remedy for, and are much employed in, gonorrhœa and gleet.

Cubebs are but little employed except in these affections, but they have been also found useful in broncorrhœa and cystitis. In gonorrhœa they should not be administered until the active inflammatory symptoms have subsided.

2. Oleum Cubebæ.—*Preparation and Characters.*—Oil of Cubebs is obtained in this country by distilling the powdered fruit with water, by steam at a high temperature; the yield varies from 6 to 15 per cent., according to the temperature employed and other circumstances. It is greenish-yellow or colourless, with the odour of cubebs, and a warm, aromatic, camphoraceous taste; it is lævogyrate, boils between 430° and 482°, and is polymeric with oil of turpentine. In cold weather it deposits rhombic octohedra, which are regarded as a hydrate of the oil, and hence this stearoptene is termed *hydrate of cubebene* or *camphor of cubebs.* Oil of cubebs frequently thickens by long keeping, but retains its odour; its specific gravity is 0·929.

Medical Properties and Uses.—Oil of cubebs has until within the last few years been generally regarded as the essential constituent of the fruits, so far as their medicinal activity was concerned, but the carefully conducted experiments of Bernatzik and Schmidt, and also of Heydenreich, indicate that the special efficacy of cubebs depends entirely upon the resins, the essential oil being simply stimulant and carminative. In this country and elsewhere, however, the oil is frequently administered as a substitute for the fruit, and in similar cases. The experiments above alluded to would, however, point to an alcoholic extract, or the purified resins, as the most active preparations of cubebs.

Per. Mat. Med., vol. ii, pt. 1, p. 392; Per Mat. Med., by B. and R., p. 518; Pharmacographia, p. 526; U. S. Disp., by W. and B., pp. 349, 1306, and 1316; Heydenreich, in Amer. Journ. Pharmacy, Jan., 1868, p. 42, and Pharm. Journ., ser. 2, vol. ix, p. 540; Procter, in Amer. Journ. Pharm., vol. xviii, p. 168; Wiggers and Husemann, Jahresbericht, 1870, p. 52; Schulze, in Year Book of Pharmacy, 1874, p. 60, from Pharm. Centralhalle, 1873, No. 29, p. 242; Proc. Amer. Pharm. Assoc., 1874, vol. xxii, p. 165, from Arch. Ph., 1873, p. 388; Proc. Amer. Pharm. Assoc. vol. xxiii, 1875, p. 330.

DESCRIPTION OF PLATE.

Drawn from a plant cultivated in the Royal Gardens, Kew; the male flowers after Hayne, the fruit from a specimen in the Pharmaceutical Society's Museum.

1. Portion of a female plant.
2. Spike of flowers.
3. Section of the same.
4. A single flower.
5. Bracts.
6. Raceme of ripe fruit.
7. A single fruit.
8. Vertical section of the same.
9. Spike of male flowers.
10. Upper part of the same.
11. A male flower.

(2–5, 8, 10, 11 enlarged.)

D.Blair ad sicc. del. et lith.

M&N.Hanhart imp.

PIPER LONGUM, *Linn.*

N. Ord. PIPERACEÆ.

Genus Piper, *Linn.*

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244. Piper longum, *Linn., Sp. Plant., ed.* 1, *p.* 29 (1753).

Long Pepper. *Pippul* (Bengal).

Syn.—Chavica Roxburghii, *Miquel.*

Figures.—Nees, t. 23; Hayne, xiv, t. 20; Wight, Ic. Plant. Ind., vi, t. 1928; Miquel, Illust. Pip., t. 30.

Description.—A small shrub with a large woody root and numerous creeping, cylindrical, smooth, jointed stems, thickened at the nodes, young shoots quite glabrous or slightly downy. Leaves alternate, without stipules, spreading, the lower ones stalked, petioles slender, the longest 2 inches long, the upper leaves sessile or nearly so, blade varying greatly in size, the lowest three inches long and nearly as wide, the uppermost not more than 1 inch long and not half as wide, cordate at the base, acute and often somewhat attenuate at the apex, entire, smooth, somewhat flaccid, strongly 5-nerved, dark green, paler beneath. Flowers unisexual, dicœcious, minute, the male in rather lax spikes which are 1—2 inches long, each with two very shortly stalked orbicular bracts at the base, the female very densely packed on a short fleshy axis, each with a bract at its base consisting of a circular entire thin scale supported by a short thick stalk attached to its back below the centre, the whole forming a solid dense spadix or spike about 1 inch long; spikes all stalked, coming off opposite the leaves. Male flowers:—perianth none; stamens 2, with short broad filaments and anther-cells separated below. Female flowers:—perianth none; stamens wanting; ovary as in the last; style divided into 4 recurved stigmas. Fruit similar in structure to the last, about $\frac{1}{10}$ inch long, ovoid-compressed, pointed, many closely packed on the axis and fused together into a solid, cylindrical, slightly tapering, reddish-brown, spike-like cone about $1\frac{1}{2}$ inch long and $\frac{1}{4}$ thick. Seed as in the last.

Habitat.—This sort of pepper is found wild on the borders of

streams and similar places growing amongst other bushes in many parts of Southern and Eastern India, especially the Malabar and Coromandel coasts, where it is also largely cultivated. It grows also in Ceylon, Timor, and the Philippine Islands. August and September are the flowering period, and in Bengal, where the plant is also cultivated, the fruit is mature in January. There is a specimen in cultivation at the gardens of the Royal Botanic Society, Regent's Park.

Long Pepper is also produced in Java, the species which is there grown being *P. officinarum*, Cas. DC. (*Chavica officinarum*, Miquel), figured in Miquel's 'Illust. Pip.,' tt. 34, 35, & Hayne, xiv, t. 21. This is a native of many of the Indian islands, and may be known from *P. longum* by its narrow leaves, attenuated at the base, with pinnate venation.

Miquel's genus *Chavica* is characterised by its dicœcious flowers, stalked bracts, and sessile fruits; the species are all Asiatic.

Roxb., Fl. Indica, i, p. 154; Miquel, Fl. Ind. Bat., i, ii, pp. 440; Cas. DC., in DC. Prod., xvi, pt. i, p. 355; Miquel, in Nova Acta Leop.-Car. Acad., xxi, Supp., p. 33 (1846).

Part Used and Name.—Piper Longum; the dried unripe spike of fruits. It is not now official in the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States; but it was formerly recognised in the London and Edinburgh Pharmacopœias.

Preparation and Commerce.—Long Pepper is gathered in January, when the spikes of fruits are full grown but yet unripe, because if left till they are quite ripe their pungency is to a great extent lost. It is then dried by exposure to the sun. Long Pepper is chiefly imported from Singapore, whither it is derived in a great measure from Java, but to some extent also from Rhio. By far the larger proportion is shipped from Singapore to British India, about 500 cwt. only, out of an average of 4000 cwt., being annually sent to the United Kingdom. The botanical source of the pepper from Java is chiefly *Piper officinarum*, DC. Long

Pepper is also largely exported from Calcutta; its source being *Piper longum*, Linn., the species now being described.

General Characters and Composition.—The long pepper of English commerce, which, as just noticed, is chiefly the produce of Java, is cylindrical in form, somewhat tapering above, marked with superficial spirally arranged furrows, from an inch to an inch and a half in length, and about a quarter of an inch in thickness. It has a brownish-white colour from having been rubbed in lime or some other earthy powder, but when washed, its natural colour is seen to be deep brownish-red. It has an agreeable, somewhat aromatic odour; and a very pungent aromatic taste. It is more pungent than black pepper. Long Pepper consists of a number of minute sessile fruits, each being crowned with the remains of the stigma in the form of a small point; and the whole closely arranged around a common axis, and supported on a short stalk.

The constituents of long pepper, as shown by Dulong in 1825, are closely analogous to those of black pepper, being essentially *volatile oil*, *resin*, and *piperin*; no more recent analysis appears to have been made. These constituents are described under *Piper nigrum*.

Medical Properties and Uses.—The properties and uses of long pepper are similar to those of black pepper, under which they are given in detail. The latter has now, however, almost entirely replaced the former in medicine; but long pepper is still used to some extent in veterinary practice. The chief consumption of long pepper is in pickling, and for culinary purposes.

The root of the long pepper plant is highly prized as a medicine by the Hindoos; and is also in use by the Persians and Arabs. It is the *pipli-mûl* or *peepla-mool* of the Taleef Shereef. Its properties are similar to, but less stimulant than, the fruit.

Per. Mat. Med., vol. ii, pt. i, p. 390; Pharmacographia, p. 524; Pharmacopœia of India, p. 208; A. Wynter Blyth, in Chem. News, Oct. 9, 1874, and Pharm. Journ., vol. v, ser. 3, p. 342; Roxburgh, Flora Indica, p. 155; Ainslie's Mat. Med. Ind.; Journ. de Pharm., Fevrier, 1825.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum collected by Koenig on the Coromandel coast; the male flowers added from Miquel.

1. Young shoot of a female plant with half ripe fruit-spikes.
2. Portion of a flower spike.
3, 4. A flower bract.
5. Female flower.
6. Ripe fruit spike.
7. Transverse section of the same.
8, 9. A fruit.
10. Spike of male flowers.
11. Male flower.
12. A stamen.

(2–5, 7, 9, 11, 12 enlarged.)

D.Blair ad. sicc. del. et lith.

M&N.Hanhart imp

PIPER NIGRUM, *Linn.*

N. Ord. PIPERACEÆ.

Genus Piper, *Linn.*

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245. Piper nigrum, *Linn., Sp. Plant., ed.* 1, *p.* 28 (1753).

Black Pepper. *Murich* (Bengal).

Syn.—P. trioicum, *Roxb.*

Figures.—Miller, Illustrations, cop. in Woodville, t. 246; Nees, t. 21; Steph. & Ch., t. 174; Hayne, xiv, t. 6; Bot. Mag., t. 3139; Miquel, Illust. Pip., tt. 50, 51; Wight, Ic. Pl. Ind., tt. 1935-6; Baill., Hist. Pl., iii, figs. 497, 503-6.

Description.—A trailing or climbing shrub, reaching a height of 20—30 feet, the old stems woody, rough, the younger much branched dichotomously, smooth, thickened at the joints, from which arise adventitious rootlets which attach themselves to neighbouring supports, or root in the soil. Leaves alternate, without stipules, widely spreading, on rounded petioles about ½ inch long; blade 4—6 inches long, oval or ovate, acute at base and apex, entire, smooth on both surfaces, leathery, dark green and shining above, paler beneath, with 5 to 7 prominent nerves from the base connected by reticulations. Flowers usually unisexual, and either monœcious or dioœcious, sometimes hermaphrodite, sessile, each sunk in a hollow excavated in the substance of slender filiform, stalked, pendulous spadices, 3—6 inches long, coming off opposite the upper leaves; the female flowers rather laxly arranged, each in the axil of a small, tongue-shaped, entire, fleshy, spreading or reflexed bract; the males more crowded. Male flowers:—perianth absent; stamens 2, filaments very broad and thick, anthers with the cells widely separated. Female flowers:—perianth absent, ovary nearly spherical, no style, stigmas 3 (or 4), sessile, spreading. Fruit berry-like, sessile, irregularly and somewhat laxly placed on the slender more or less pendulous spikes, nearly globular, less than ¼ inch in diameter, smooth, marked at the summit by the remains of the stigmas, at first green, then red, yellow when quite ripe; pericarp fleshy,

thin. Seed solitary, testa thin, brown, embryo as in the other species.

Habitat.—The Black Pepper is a native of Southern India, especially the Malabar coast, growing in rich soil in the shade of trees, to the trunks of which it adheres by means of its ivy-like rootlets (figured in the 'Bot. Mag.' plate), though it does not usually climb to any great height. It is also met with in other parts of the Indian peninsula, and in Ceylon, Singapore, Penang, Borneo, Luzon, Java, Sumatra, and the Philippine islands, in all of which places it is considered to have been introduced. Its cultivation is carried on in all these countries, but especially in South-Western India ; it has been also tried in the West Indies. From its climbing habit it has received the name of Pepper Vine, and in cultivation the plants are often trained on artificial supports. The flowering and fruiting take place irregularly, the berries taking about five or six months to come to a proper state for gathering, which is before they are fully ripe. Though grown in our stoves, having been introduced in 1790, it has not produced flowers in this country.

The *P. trioicum* of Roxburgh is considered to form a variety only by C. de Candolle. It bears catkins of hermaphrodite flowers or of hermaphrodite and female flowers mixed, but does not appear to materially differ from *P. nigrum* in other respects.

Roxb., Fl. Ind., i, pp. 150, 151; Cas. DC., in DC. Prod., xvi, pt. i, p. 363; Miquel, in Nova Acta Leop.-Car. Acad., xxi, Supp., p. 50; Lindl., Fl. Med., p. 310; Flück. & Hanb., Pharmacogr., p. 519.

Official Part and Names.—Piper Nigrum ; the dried unripe berries (B. P.). The dried unripe berries (I. P.). Piper ; the unripe berries (U. S. P.).

Preparation, Commerce, and Varieties.—As soon as the fruits (berries) at the base of the spike begin to change in colour from green to red, the whole spike is gathered; for if allowed to remain until fully ripe, the berries become less pungent, and, moreover, easily fall off. The day after the berries are gathered they

are separated from their stalks by hand-rubbing, and picked clean ; they are then dried by exposure to the sun, or more frequently by the heat of a gentle fire.

Pepper (including black and white) is chiefly imported into the United Kingdom from Singapore, and is essentially the produce of the Straits Settlements, but some comes from British India and other parts. In 1872, the former districts supplied about 25,000,000 lbs., the latter only 256,000 lbs., and the total importation from all parts was 27,576,710 lbs. Of this quantity about two thirds were again exported from the United Kingdom to Germany, Italy, Russia, Holland, Spain, and other countries, thus leaving about 10,000,000 lbs. for home consumption. The principal varieties of black pepper are Malabar, Cochin, Penang, Singapore, and Siam. Malabar is the most esteemed.

General Characters and Composition.— The black pepper of commerce is a small roundish fruit of about $\frac{1}{5}$ of an inch in diameter ; it has a blackish-brown colour, and is wrinkled on its surface. The thin pericarp encloses a single hard smooth roundish seed, which has a brown colour, and is horny externally, and mealy within. Black pepper has an aromatic odour, and a pungent, somewhat bitterish taste. The heavier the pepper, the more it is valued ; the heaviest of all is commonly called *shot pepper*.

The principal constituents of black pepper are *resin*, *volatile oil*, and *piperin* or *piperia*. It also contains a little *fatty oil*, *starch*, and other ingredients ; and about 5 per cent. of inorganic matter may be obtained from it by incineration. The *resin* is a soft substance, with a very acrid pungent taste, and to its presence the properties of pepper as a stimulant are more particularly due ; it is contained in the proportion of about 18 per cent. The amount of *volatile oil* is from about 1·6 to 2·3 per cent., and to it the odour of pepper and its aromatic taste are due. In composition it is isomeric with oil of turpentine. *Piperin* or *piperia* is a neutral or feebly alkaline, crystalline substance, occurring in the proportion of from 2 to 3 per cent. It is identical in composition with morphia ; it is insoluble in water, but readily soluble in alcohol ;

and when pure is colourless, and without taste or smell. It is resolvable into *piperic acid* and *piperidia ;* the latter is a powerful liquid colourless alkaloid with an ammoniacal and somewhat peppery odour, and readily forms crystalline salts with acids. Piperin is regarded as the constituent to which the supposed febrifuge properties of pepper are due.

Adulteration.—Black pepper is not liable to adulteration in its entire state, but when powdered, it is frequently mixed with various kinds of starch, mustard husks, linseed, capsicum, &c. These substances are readily detected by careful observation under the microscope and the use of reagents. It should be noticed, however, that starch is one of the natural constituents of pepper, but its small size at once distinguishes it from all other starches except that of rice, the granules of which, according to Evans, are very nearly the same size as those of pepper starch.

Medical Properties and Uses.—Black pepper is an aromatic carminative stimulant ; and is also supposed to possess febrifuge properties. Its action as a stimulant is more especially evident on the mucous membranes of the rectum and urinary organs. Externally applied it is rubefacient. It is regarded as a useful remedy in hæmorrhoidal affections, and in relaxed conditions of the rectum attended with prolapsus ; it is also sometimes employed as a substitute for cubebs in gonorrhœa, &c. It is likewise given in combination with aperients to facilitate their action and prevent griping. Black pepper has long been a popular remedy in this country and some other parts of the world in intermittent fevers. Both it and piperin, to which its reputed febrifuge property is due, have also been largely used in regular medical practice in the treatment of intermittent fevers ; but rarely with any evident benefit, hence they are now but very little employed. As a masticatory, or when locally applied as a gargle, pepper has been found useful in relaxed uvula, paralysis of the tongue, and in other affections of the mouth or throat.

Black pepper is, however, principally employed as a condiment, partly for its flavour, and partly on account of its

stimulant influence over the stomach, by which it assists digestion; it is consequently of especial value for persons suffering from atonic or torpid conditions of the stomach.

White Pepper.—*Preparation and General Characters.*—White pepper is prepared from the ripe fruits of the black pepper plant. The process varies somewhat in different districts, but the spikes of ripe fruit are commonly left for two or three days after being gathered; they are then washed and bruised with the hand in a basket or some other suitable receptacle, till all the stalks and the soft dark outer layer of the pericarp are removed, and are finally dried. Hence white pepper is the fruit deprived of the greater portion of the pericarp, in fact, is but little more than the seed. These grains, as the prepared fruits are then commonly called, are somewhat larger than black pepper, smooth, nearly round, and of a greyish or yellowish-white colour. They are hard and horny externally, and mealy within; their taste and odour are similar to, but less marked than, black pepper.

Varieties.—Four varieties of White Pepper are commonly distinguished in commerce, namely, Tellicherry, which is the finest, Penang, Batavia, and Singapore. It is principally prepared in the Straits Settlements, from whence between two and three millions of pounds are annually exported, and chiefly to China.

The white peppers of commerce are frequently bleached; and an attempt has been made to convert black to white pepper, by depriving it of the outer portion of the pericarp by mechanical trituration. The pepper formerly known as *Fulton's decorticated pepper* was thus prepared, but the loss in weight was so great, and the article so inferior in quality, that the process is not now carried on.

Composition, Adulterations, and Uses.—In its chemical constitution white pepper contains essentially the same constituents as black pepper, but in somewhat different proportions. It is liable to similar adulterations as black pepper, and these may therefore be detected in like manner. Its properties and uses are also similar

to those of black pepper. Black pepper is, however, commonly preferred as a spice, at least in Europe and the United States, and is alone official. But in China, white pepper is highly esteemed.

Per. Mat. Med., vol. ii, pt. 1, p. 384; Per. Mat. Med., by B. and R., p. 514; Pharmacographia, p. 521; Steph. & Church., by Burnett, vol. iii, pl. 174; U. S. Disp., by W. & B., p. 675; Hassall, Adulterations in Food and Medicine, 2nd edit., p. 356; Watts' Dict. of Chem., vol. iv, pp. 653—659; Evans, in Pharm. Journ., vol. i, 2nd ser., p. 605; Chem. Gaz., Aug., 1849, p. 309, May 1, 1852, p. 167, and Jan. 1, 1858, p. 7; Blyth, in Chem. News, Oct. 9, 1874, and Pharm. Journ., vol. v, ser. 3, p. 342; Ainslie, Mat. Med. of Hindostan, p. 34.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum collected in India by Wallich and the Straits of Sunda by Staunton; the hermaphrodite flower added from Miquel.

1. A spike of female flowers.
2. Portion of the spike.
3. A branch with fruit.
4. A fruit.
5. Section of the same.
6. A hermaphrodite flower.
7. A stamen.

(2, 4–7 enlarged.)

D.Blair, F.L.S. ad sicc. del. et lith.

M&N. Hanhart imp

ARISTOLOCHIA SERPENTARIA, *Linn.*

N. Ord. ARISTOLOCHIACEÆ. Lindl. Veg. Kingd., p. 792; Le Maout & Dec., p. 705.

Genus **Aristolochia**, *Linn.** Duchartre in DC. Prod., xv, pt. i, pp. 432—498. Species over 180, found in the warmer countries throughout the world.

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246. Aristolochia Serpentaria,† *Linn., Sp. Plant., ed.* 1, *p.* 961 (1753).

Virginian Snakeroot.

Syn.—A. officinalis, *Nees.* A. sagittata, *Muhl.* A. hastata, *Nutt.* Endodeca Bartonii, *Klotzsch.* E. Serpentaria, *Klotzsch.*

Figures.—Woodville, t. 59; Bigelow, t. 49; Barton, t. 28, copied in Hayne, ix, t. 21; Steph. & Ch., t. 180; Nees, t. 143; Berg & Sch., t. 25 a.

Description.—A perennial herb, with a short horizontal rhizome giving off very numerous long, slender, crowded roots below. Flowering stems about a foot high, branched at the base, slender, cylindrical, flexuous or ziczac, pubescent, purple below. Leaves few, on the upper part of the stem, alternate, stalked, without stipules, two or three inches long, usually ovate-attenuate, with a cordate base, sometimes narrower and oblong or even linear, entire, minutely pubescent, especially when young. Flowers few, solitary, not an inch long, on rather long, filiform, flexuous stalks, which come off horizontally from the axils of small scales at the lower nodes of the stem, curved downwards at the ends, with several distant bractlets at intervals. Perianth adherent to the ovary (superior), tubular, hairy on the outside, smooth within, tough, dark brownish-purple, deciduous, the tube cylindrical, inflated above the ovary, then much narrowed, then again inflated, and finally narrowed at the mouth, which is turned upwards, the

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* *Aristolochia, ἀριστολοχία*, the classical name for *A. Clematitis* and *A. rotunda*, from their supposed virtues.

† The *Serpentaria virginiana* of Plukenet (1691), from its use in snake-bites.

limb vertical, flat, obscurely 3-lobed. Stamens epigynous, filaments fused with the style, anthers 6, 2-celled, apparently sessile and adnate to the under surface of the stigma, two under each of its lobes, dehiscing vertically. Ovary inferior, ovoid-pyriform, bluntly 6-angled, covered with short reflexed hairs, 3-celled, with a double row of ovules attached to the axile placentas; styles combined into a short thick column; stigma large, divided into 3 broad, flat, truncate lobes. Fruit a small dry capsule, partially dehiscent septicidally, flattened above, 6-angled, 6-celled, pericarp thin, papery, smooth, dark brown. Seeds several in each cell, bluntly triangular, very flat, convex and somewhat warted on the lower surface with the margin inflexed, hollowed on the upper surface, where it is traversed across the centre by the thick, white, fleshy raphe, embryo very small at the end next the hilum, endosperm abundant, densely fleshy.

Habitat.—A native of the United States of America growing in moist fertile woods in all except the most Northern States, but not generally a very common plant. It flowers in June and July, the singular blossoms being more or less buried in the loose soil and dead leaves near the root; the seeds are ripe at the end of September. It was grown in an English garden so far back as 1632. There is a plant in cultivation at Kew, but it has not flowered there.

The genus *Endodeca* was defined by Klotzsch from this species, which he divided into three; it possesses, however, no characters distinguishing it from *Aristolochia*.

The great variation in the form of the leaves has caused the creation of several supposed species. Barton's figure above quoted is the variety *Bartonii* of Duchartre, *Endodeca Bartonii*, Klotzsch, *Aristolochia officinalis*, Nees.

An allied species, *A. reticulata*, Nutt, native to the Western United States, yields the Texan or Red River Snakeroot.

A. Gray, Man. Bot. N. U. St., p. 404; Chapman, Fl. South. States, p. 272; Lindl., Fl. Med., p. 343; Duchartre, in DC. Prod., xv, i, p. 433; Klotzsch, in Monatsbericht der K. Akad., Berlin, 1859, pp. 575, 600.

Official Part and Names.—Serpentariæ Radix; the dried rhizome (B. P.). The dried root (I. P.). Serpentaria; the root of Aristolochia Serpentaria, of Aristolochia reticulata, and of other species of Aristolochia (U. S. P.).

Collection and Commerce.—Serpentary rhizome, Serpentary root, or as it is also termed Virginian Snakeroot, is principally collected in Western Pennsylvania and Virginia, but also in Ohio, Indiana, and Kentucky. It is commonly imported into this country in bales, casks, or bags, from New York and Boston.

General Characters and Composition.—The so-called Snake-root or Serpentary root of commerce consists in reality of the rhizome and of a tuft of numerous small roots arising from its lower surface. The rhizome presents a twisted and knotty appearance; it is usually about an inch in length, by about one eighth of an inch in thickness, and is marked on its upper surface by the short projecting bases of the aërial stems which it once bore. In some cases we also find attached to the rhizome longer portions of the herbaceous stem, together with leaves, flowers, and fruit. From the under surface of the rhizome numerous slender branched rootlets arise, varying from 2 to 4 inches long, and forming together a compact interlacing tuft. Serpentary has a yellowish or brownish colour; a bitterish, aromatic, somewhat valerianaceous and camphoraceous taste; and a strong, aromatic, not unpleasant odour, resembling a mixture of valerian and camphor.

The principal constituents of serpentary root are, a *volatile oil* in the proportion of about ½ per cent. and a *bitter principle*. The volatile oil has the odour of the root, and the bitter principle (*aristolochin*), which was first made known by Chevallier, is described as an amorphous substance of a yellow colour, a bitter and slightly acrid taste, and as soluble in both water and alcohol. It requires further investigation. The medicinal properties of serpentaria are doubtless essentially, if not entirely, due, to these two substances. But serpentary root also contains *tannic acid, resin, mucilage, sugar,* and some other unimportant ingredients.

Substitutions and Adulterations.—In the United States the

rhizomes and rootlets of other species of Aristolochia, more especially those of *Aristolochia reticulata*, Nutt, are sometimes substituted for the serpentary root derived from Aristolochia Serpentaria; indeed, these parts of *Aristolochia reticulata* are official in the Pharmacopœia of the United States. This serpentary root closely resembles the old serpentary root in odour and taste, although it is somewhat less aromatic; and also in appearance, except that the rhizome is a little thicker, and the rootlets less matted together. Should any of the leaves, however, be mixed with this root they are at once a distinguishing character, being nearly sessile, leathery in texture, and evidently reticulated on their lower surface. This Serpentary root is commonly known as *Texan* or *Red River* Snakeroot. Examined by Mr. Thomas Wiegand, of the United States, it was found to have essentially the same chemical composition as the true serpentary root. The rhizomes and rootlets of other species of *Aristolochia*, as, for instance, those of *A. hirsuta*, Muhl, are also said to be sometimes mixed with the rhizomes and rootlets of *A. Serpentaria*.

Various other roots and rhizomes are also occasionally substituted for, or mixed with, serpentary root, either fraudulently or by accident, such as the roots of *Spigelia marilandica*, L., the rhizomes of *Cypripedium pubescens*, L., and of *Hydrastis canadensis*, L.; and the roots of *Panax quinquefolium*, L. These are all readily distinguished from Serpentary root if only ordinary care be exercised, as their characters are very different from it, and need, therefore, no further notice from us.

Medical Properties and Uses.—As its common and specific names of Snakeroot and Serpentaria imply, Serpentary had formerly a high reputation for the cure of the bites of venomous serpents; indeed, it was first introduced into regular medical practice as a remedy in such cases, but like all the so-called specifics of vegetable origin which have been introduced for destroying the effects caused by venomous reptiles it is no longer regarded as of any remedial value. As a stimulant, tonic, diaphoretic, and diuretic, it is, however, a medicine of some repute; but in too large doses it causes nausea, flatulency, griping

pains in the bowels, and tendency to diarrhœa. It has been extensively employed in typhus and typhoid fevers; and has also been highly recommended in intermittent fevers; but in the latter it is commonly given as an adjunct to bark or sulphate of quinia, whose effects it is said to increase in a marked degree. It has likewise been employed as an antidote against the bite of a mad dog, but it has no more value in destroying the effects in such a case than as a remedy in the bites of venomous reptiles. It is, however, used with good results in diphtheria, chronic rheumatism, atonic dyspepsia, and in exanthematous diseases to promote eruption. A strong infusion is also reputed to be serviceable as a gargle in malignant sore throat. Garrod states, that from observations made during many years, he "is inclined to think that serpentary is a remedy of some considerable power, acting in a manner not unlike Guaiacum in stimulating the capillary circulation, and promoting recovery in chronic forms of gouty inflammation; and as it does not disturb the bowels, it may often be administered when Guaiacum is not easily tolerated."

Gerarde's Herball, by Johnson (1632), p. 849; Dale's Pharmacologia (1693); Steph. & Church., Med. Bot. by Burnett, vol. iii, pl. 180; Per. Mat. Med., vol. ii, pt. i, p. 433; Pharmacographia, p. 532; Garr. Mat. Med., p. 345; U. S. Disp. by W. & B., p. 803; Chevallier, Journ. de Pharm., vol. vi, p. 365; Wiegand, in Amer. Journ. Pharm., vol. x, 1845; Maisch, in Am. Journ. Pharm. (1874), p. 106; Proc. Amer. Pharm. Ass. (1873), p, 441; Millemann, in Amer. Journ. Pharm., 4th ser., vol. iv, p. 511, and Year Book of Pharmacy (1875), p. 210.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected in Florida.

1. A complete plant.
2. Vertical section of a flower.
3. Flower with the perianth removed.
4. Transverse section of the ovary.
5. Fruit.
6, 7. Upper, and—8. Under surface of the seed.
9 and 10. Sections of the same.

(3, 4, 7, 8, 9, 10 enlarged.)

5
6
2
3
4
7
1
8

N. Ord. JUGLANDEÆ. Lindl., Veg. Kingd., p. 292; Le Maout & Dec., p. 711.

Genus Juglans,* *Linn.* Cas. DC. in DC. Prod., xvi, pt. 2, pp. 135—139. Species 8, found in the warm and temperate regions of the northern hemisphere.

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247. Juglans cinerea, *Linn., Sp. Plant., ed.* 2, *p.* 1415 (1762).

Butter-nut. Oil-nut. White-nut.

Syn.—J. cathartica, *Michaux.*

Figures.—Bigelow, t. 32; Michaux, N. Amer. Sylva, i, t. 31; Jacquin, Ic. Plant. Rar., i, t. 172.

Description.—A tree of 30—50 feet high, with long and wide-spreading branches forming a large flat head; bark smooth, dark grey; buds white, densely tomentose, usually 2 or 3 superposed above the leaf-axils, young twigs covered with a reddish tomentum. Leaves alternate, large, about 1 foot long, without stipules, petiole and rachis densely pubescent, impari-pinnate, leaflets opposite or sub-alternate in 7—10 pairs and an odd one, sessile, ovate-lanceolate, the lower ones about 3 inches long when full grown, but the more distal ones considerably smaller, rounded at the base, very acute or acuminate at the apex, finely serrate, thin, puberulous above, strongly pubescent below. Flowers unisexual, monœcious, the male in slender catkins 3—5 inches long, from the leaf-axils of the previous year, the female 3 or 4 together at the end of stout, long, hairy, axillary or terminal peduncles on the new shoots. Male flowers :—perianth and bract fused to form a horizontal, rather flat, smooth scale, with a terminal lobe and 4 or 5 lateral ones, and bearing the stamens on its under surface; stamens 8—12, irregularly arranged on the bract, anthers almost sessile, ovoid-oblong, 2-celled, apiculate. Female flowers :—perianth double, the tube united with the ovary, densely glandular, pubescent externally, the outer limb (calyx)

* *Juglans*, the classical name for the walnut tree, *J. regia*, Linn., contracted from *Jovis glans*, Jupiter's nut. The Greeks called it καρύα and καρύα βασιλικη, the royal nut.

cup-shaped, 3- or 4-toothed, the inner (corolla) 4-toothed, rather longer than the outer, pubescent on the outside; ovary fused with the perianth-tube (inferior), 1-celled with a single sessile, erect, orthotropous ovule on a columnar basal placenta, style very short, stigmas 2, large, spreading, linear-oblong, flat, fringed, pink, deciduous. Fruit a large drupe, about 2½ inches long, oblong-ovoid, often bluntly-pointed, hairy and very viscid, at first yellowish-green, afterward brown, pericarp of two parts, the outer rind or epicarp (formed from the thickened and enlarged perianth-tube) fleshy, tough, indehiscent, the inner nut, stone, or endocarp (formed from the altered ovarian walls) very hard and bony, united with the rind, ovoid, pointed at both ends, its surface very rough and irregular with ridges, of which 8 longitudinal ones are more prominent, 1-celled above, incompletely divided into 2 cells below by 2 ventral, thick, hard, lacunose dissepiments, splitting into 2 valves in germination. Seed solitary, large, completely filling the cavity, testa membranaceous, embryo with very large, fleshy, bifid, lobed cotyledons, radicle small, pointed, superior; no endosperm.

Habitat.—A common tree in the rich woods of North America, being found in Upper and Lower Canada, and in most of the Northern United States, and extending into the Southern ones, on the hills. It is grown in our botanic gardens and plantations here in England, having been introduced about the middle of the 18th century. The flowers appear in April or May, before the leaves are fully grown, and the fruit is ripe in the middle of September.

The common walnut, *J. regia*, Linn., is a native of Persia and the Himalaya, and perhaps China, but was cultivated in the Mediterranean region in very early times, whence it spread to Northern Europe. In this country it was cultivated before 1562. It is figured in Hayne xiii, t. 17, and Berg. and Schmidt, t. 86. All the other species of the genus are found in the New World.

A. Gray, Man. Fl. N. U. States, p. 477; Hook., Fl. Bor.-Am., ii, p. 143; Chapman, Fl. South. States, p. 419; Cas. DC. in DC. Prod., xvi, pt. 2, p. 137; Lindl., Fl. Med., p. 307.

Official Part and Names.—JUGLANS; the inner bark of the root (U. S. P.). It is also called *Butternut* in the Pharmacopœia of the United States. It is not official in the British Pharmacopœia, or the Pharmacopœia of India.

Collection.—The inner bark is the only part used in medicine, and as that of the root is regarded as the most active, it is alone official. It should be collected in May or June.

General Characters and Composition.—When the outer bark is first removed the inner bark is pure white, but on exposure to the air it soon becomes of a fine lemon colour, and ultimately, when dry, as seen in the pharmacies, it is deep brown. It is in thin shreds, or pieces of varying length, which are tough and fibrous, and therefore powdered with difficulty. It has a feeble odour; and a peculiar, somewhat acrid, bitter taste.

It has been examined by Bigelow, Thibaud, Wetherill, and E. S. Dawson. The latter found it to contain *tannic acid, glucose, resin, volatile oil,* and a *volatile acid.* The acridity of the drug, which is observable in the infusion, but not in the decoction of the bark, he attributes to the volatile acid. This was obtained from the aqueous distillate by agitating it with ether, and allowing the ethereal solution to evaporate spontaneously, when an orange-coloured residue was formed, in which were numerous acicular crystals. These had an acid reaction, a hot, acrid taste, and were coloured deep violet by the action of solution of potash. Dawson found the volatile oil to have a peculiar and not very pleasant odour, but it was obtained in too small a quantity for complete examination.

Medical Properties and Uses.—Butternut or white walnut bark, is a mild cathartic, resembling rhubarb in its action, as it operates without causing griping or subsequently debilitating the intestines. When applied to the skin it acts as a rubefacient, or even, it is said by Stillé, as a vesicant. In the United States Pharmacopœia, the only official formula is the extract, which is given in doses of five to ten grains as a laxative, and from twenty to thirty grains as a purgative. It was much employed in the United States during the last war as a substitute for rhubarb;

and has acquired much reputation as an aperient in habitual constipation, "since it does not tend so much as many other purgatives to leave the bowels in a confined state." It has also been administered with success in dysentery; and in connection with calomel, Dr. Wood, of the United States, states that "it has sometimes been used in our intermittent and remittent fevers, and other complaints, attended with congestion of the abdominal viscera."

Besides the employment of the bark in medicine, it is also occasionally used in dyeing wool of a dark brown colour, although in this respect it is said to be inferior to that of the common walnut (*Juglans regia*). The wood is also described as useful "on account of its durability and exemption from the attacks of worms." The half-grown fruit is likewise employed for pickling; and the ripe seeds are eaten like those of the common walnut.

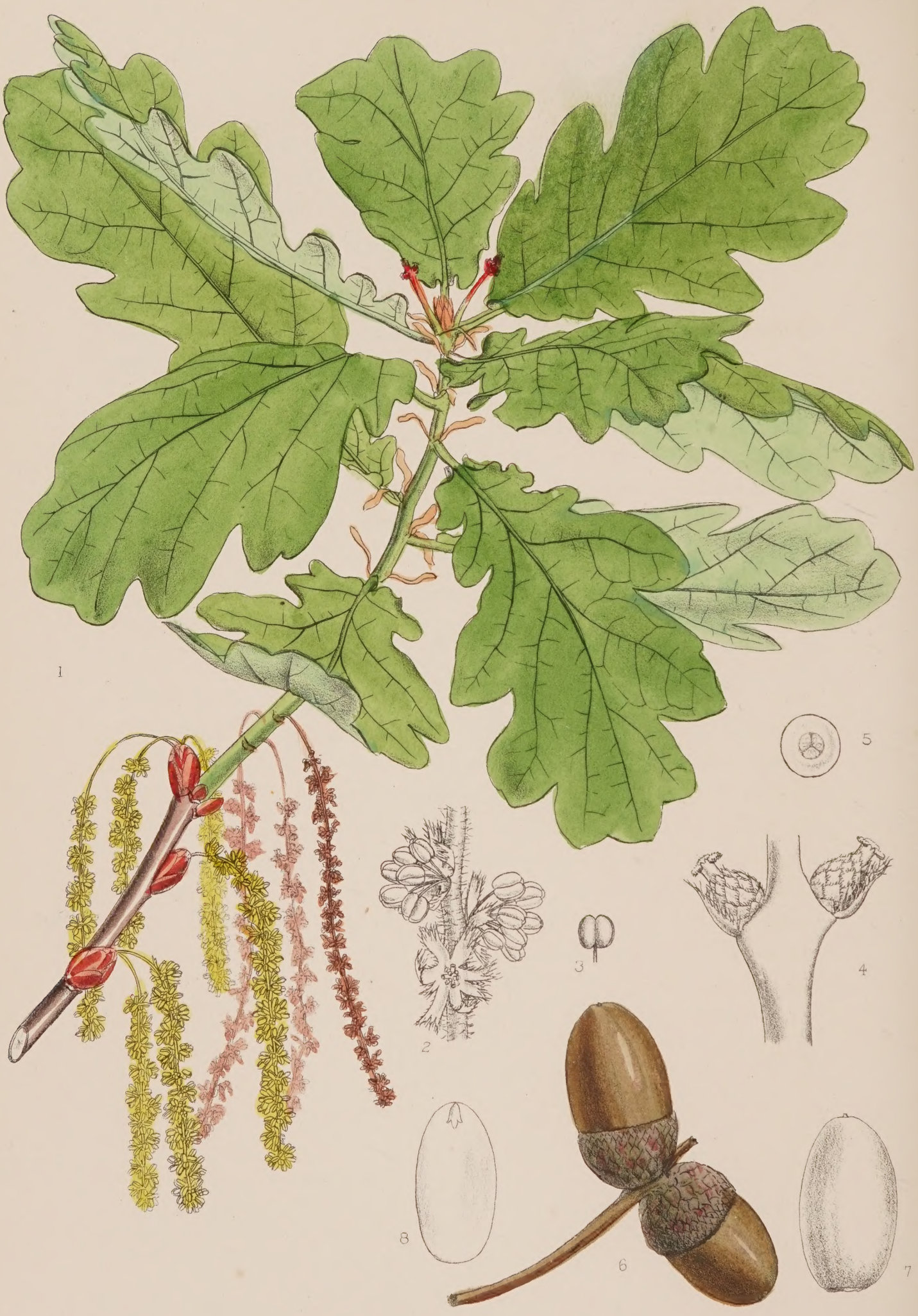
Per. Mat. Med., vol. ii, pt. 2, p. 703; U. S. Disp., by W. & B., pp. 505 & 1143; Wood's Therapeutics and Pharmacology, vol. ii, p. 494; Stillé's Therap. & Mat. Med., vol. ii, p. 427; Proc. Amer. Pharm. Assoc. for 1874, vol. xxii, p. 158.

Other Medicinal Species of Juglans.—Various parts of *Juglans regia, L.*, the common walnut, have been used in medicine. Thus, the green rind of the fruit was formerly in great repute in syphilis, but it has now fallen into disuse; it has also, as well as the expressed oil of the fruit, been employed as an anthelmintic. The leaves have been highly extolled as a remedy in scrofula, by Professor Negrier, of Angers, both for internal administration and external use, and appear deserving of further trial.

U. S. Disp., by W. & B., p. 505; Watts, Dict. Chem., vol. iii, p. 444; Waring, Manual of Practical Therapeutics, p. 441; Negrier, Archiv. Gén. de Méd., 3e sér., vol. x, p. 399, and vol. ii, p. 41, also 5e sér., vol. x, p. 609; Ranking, Abstr. Med. Sci., vol. xi, p. 210.

DESCRIPTION OF PLATE.

Drawn from a cultivated specimen in the British Museum. 1. A branch with flowers and young leaves. 2, 3. A male flower. 4. The same with the anthers removed. 5. A female flower. 6. Transverse section of ovary. 7. A fruit. 8. Transverse section of the same. (3, 4, 6 enlarged.)



D.Blair, F.L.S. ad nat. del. et lith.

M& N. Hanhart imp.

QUERCUS ROBUR, *Linn.*

N. Ord. CUPULIFERÆ. Lindl., Veg. K., p. 290; Le Maout & Dec., p. 714; Baill., Hist. Pl., vi.

Tribe *Quercineæ*.

Genus **Quercus**,* *Linn.* Baill., Hist. Pl., vi, p. 256. Species 300, natives of both hemispheres, chiefly in temperate regions.

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248. Quercus Robur,† *Linn., Sp. Plant., ed.* 1, *p.* 996 (1753).

Common Oak.

Syn.—Q. pedunculata, *Ehrh.* Q. sessiliflora, *Salisb.* Q. intermedia, *Don.* Q. pubescens, *Willd.*

Figures.—Woodville, t. 10; Hayne, vi, t. 36; Steph. & Ch., t. 151; Nees, tt. 92, 93; Berg & Sch., tt. 7 f, 8 a; Syme, E. Bot., viii, tt. 1288, 1289; Reichenb., Ic. Fl. Germ., xii, tt. 644, 648; Nees, Gen. Fl. Germ.

Description.—A tree often reaching the height of 80 or 100 feet, with a massive trunk and thick, wide-spreading, much-divided twisted branches; bark grey, deeply furrowed. Leaves numerous, alternate, spreading, nearly sessile or shortly stalked, with a pair of rather large, strap-shaped, blunt, chaffy, pale brown stipules at the base which are quickly deciduous, blade 2½—5 inches long, oblong-obovate, blunt at the apex, usually rounded at the narrow, often unsymmetrical base, irregularly sinuate with unequal, obtuse, rounded lobes, 4—6 on each side, which do not reach half way to the midrib, rather stiff, shining, quite glabrous and dark green above, paler and (when young) usually somewhat downy with stellate hairs beneath, plicately folded in the bud. Flowers inconspicuous, unisexual, monœcious; the male numerous, sessile, loosely and irregularly arranged on the hairy axis of very slender, pendulous catkins which are 1—3 inches long, without bracts, and come off generally 2 or 3 together from small scaly buds in the axils of the lowest leaves, or on the wood of the previous year. Female flowers sessile, surrounded by an involucre of several rows of triangular, acute,

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* *Quercus*, the Latin name for some species of oak.

† *Robur*, also a classical name for the oak, but applied especially to its hard timber.

strongly imbricated, ciliate reddish bracts forming a bud-like cup, solitary, or two or three at the extremity of erect tapering peduncles coming from the axils of the uppermost leaves and either very short (so that the flowers themselves seem axillary), or more usually nearly half an inch long, each flower subtended by a deciduous, acute, ciliate bract about its own length. Male flowers:—perianth cup-shaped, very deeply cut into 6—8 strap-shaped segments with laciniate ends; stamens 6—8, inserted on the central receptacle, filaments short, slender, anthers 2-celled, cells rounded, connate, dehiscing longitudinally, lemon yellow, becoming brown. Female flowers:—perianth completely fused with the ovary, the limb very small, usually with 6 teeth; ovary inferior, thick and fleshy, 3-celled, with 2 erect ovules in each cell; style thick, short; stigma rather fleshy, with 3 spreading lobes. Fruit (glans) surrounded at the base by the enlarged involucre which has become a solid hemispherical cup (cupule), extending about $\frac{1}{4}$ the length of the fruit, with an entire margin and several series of strongly appressed, bluntly triangular scales on its outer surface, solitary or two or three in a cluster, sessile or on an axillary stalk which may reach 3 or 4 inches in length, about 1 inch long, oblong-ovoid, tipped by the remains of the perianth-limb and style, readily separating from the cupule when ripe, 1-celled; pericarp coriaceous, thin, smooth and shining, often faintly furrowed longitudinally, yellowish orange, indehiscent. Seed solitary (the rest abortive), completely filling the pericarp, testa thin, rather lax; embryo with very large thick plano-convex cotyledons and a short superior included radicle, no endosperm.

Habitat.—One of the commonest British trees, and forming the greater part of original woodlands in this country, throughout the whole of which it occurs. It is equally abundant and forms large forests in the rest of Europe and in Western Asia, extending into the far north, but stopping short of the Arctic districts; it also grows in North Africa and Syria. As a timber tree also it is very frequently planted, but in this country to a far less extent than was formerly the case.

The flowers appear with the young foliage in April or May, and the male catkins are sufficiently abundant to be conspicuous in spite of their small size; they fall off entire soon after the pollen is shed. The little scaly cup surrounding the stamens is above described as a perianth, but may be with equal propriety considered to be an involucre of bracts.

Botanists are not in accord as to whether *Q. sessiliflora* and *Q. pedunculata* are distinct; A. De Candolle treats them as subspecies. The latter is the more common tree in England and is the form figured. From this *Q. sessiliflora* differs technically in the want of a stalk to the acorns and the greater length of the leaf-petiole; the leaf is also more elongated and the mode of growth of the tree more erect; intermediate forms, however, occur, yet foresters generally consider the two abundantly distinct. The latter is often called the Durmast Oak. There are besides an immense number of varieties and local forms, many of which have been described as species; in De Candolle's 'Prodromus' thirteen varieties are described under the subspecies *pedunculata*, and nineteen under the subspecies *sessiliflora*.

Hook. f., Stud. Fl., p. 344; Syme, E. Bot., viii, p. 145; Watson, Comp. Cyb. Br., p. 310; Gren. & Godr., Fl. France, iii, p. 116; Ledebour, Fl. Rossica, iii, p. 589; A. DC., in DC. Prod., xvi, 2, p. 4; Willk. & Lange, Prod. Fl. Hisp., i, p. 238; Lindl., Fl. Med., p. 291.

Official Part and Name.—Quercus Cortex; the dried bark of the small branches and young stems of Quercus pedunculata, *Willd.* (B. P.). The dried bark of the small branches and young stems (I. P.). It is not official in the Pharmacopœia of the United States; the inner barks of Quercus alba and of Quercus tinctoria being there substituted for it; these are described under those two plants.

Collection and Preparation.—In the British Pharmacopœia the bark is directed to be collected in spring, from trees grown in Britain. The Pharmacopœia of India also directs the bark to be collected in the spring. This direction should be carefully attended to, because at this season the bark contains more

astringent matter, and is more easily separated from the wood than at any other period of the year. In practice, however, in this country, the usual time of barking is from the beginning of May to about the middle of July; and the process is as follows:—The barkers make a longitudinal incision with a mallet furnished with a sharp edge, and a circular incision by means of a barking bill. The bark is then removed by the peeling irons; the separation being promoted, when necessary, by beating the bark with the square end of the mallet. It is then carefully dried in the air by setting it on what are called lofts or ranges, and is afterwards stacked.

General Characters and Composition.—Oak bark is usually found in pieces of from one to two feet long, and it varies very much in appearance according to the age of the stem or branch from which it has been obtained. The bark of the small branches and young stems, which is alone official, occurs in quills which are usually about a tenth of an inch or less in thickness. It is nearly smooth externally, and of a shining silvery or ash-grey colour, variegated with brown. Internally it is cinnamon-coloured or brownish-red, and longitudinally striated. The fracture is fibrous and tough; its taste very astringent; and its odour is very feeble except when moistened, when it resembles tan. The bark of old stems is in thick, more or less flattened pieces, which are very rough externally from the presence of numerous deep cracks and wrinkles. It is very inferior in its medicinal properties to the young bark, and should not be substituted for it.

The most important constituent of oak bark is a peculiar kind of tannic acid, which was first noticed by Stenhouse in 1843, and then proved by him to be different from the tannic acid of nut-galls; it is termed *querci-tannic acid*, and according to Neubaer it exists in young oak bark in the proportion of from 7 to 10 per cent. A solution of gelatine is precipitated by an aqueous solution of oak bark; and the latter solution becomes dark blue or purple on the addition of perchloride of iron. A solution of tartarated antimony causes no precipitate with a watery solution

of oak bark. The bitter, colourless, crystallizable, neutral substance, described by Gerber, in 1843, and named *quercin*, requires further examination; the recent experiments of Eckert failed to detect it in young oak bark. Besides *querci-tannic acid*, oak bark also contains a small quantity of *gallic acid*, *pectin*, and other vegetable and inorganic constituents.

Medical Properties and Uses.—The effects of oak bark are similar to those of other vegetable astringents containing tannic acid. It is, however, but little employed as an internal remedy, although in the form of a decoction it has been found very useful in chronic diarrhœa, in the advanced stages of dysentery, and in alvine hæmorrhages, &c. But the decoction is chiefly used as a local astringent in the form of a lotion, gargle, or injection, for various purposes, as in indolent ulcers, relaxed sore throat, leucorrhœa, &c. Poultices of the powdered bark have also been applied with advantage to gangrenous and ill-conditioned ulcers.

The chief use of oak bark is not for medicinal purposes, but for tanning leather, for which purpose it has always been largely employed. It has also been used for the preparation of inks, and for other purposes.

Besides the bark the wood of this tree is well known as forming most valuable timber; and the fruits (acorns) have been also recommended as food for cattle, but recent experience would seem to show that in some cases at least, they act injuriously.

Per. Mat. Med., by B. & R., p. 492; Pharmacographia, p. 534; Bentl., Man. Bot., p. 634; Steph. & Church., Med. Bot., by Burnett, pl. 151; Watts' Dict. Chem., vol. v, p. 8; Bloxam's Chemistry, 3rd edit., p. 585.

DESCRIPTION OF PLATE.

Drawn from a tree in the Royal Gardens, Kew.

1. A young branch with male and female flowers.
2. Portion of male catkin.
3. An anther.
4. Female flowers.
5. Section of ovary.
6. Ripe fruit.
7. Acorn removed from the cup.
8. Seed, with one cotyledon removed.

(2–5 enlarged.)

D.Blair F.L.S. ad sicc. del. et lith.

M.& N.Hanhart imp.

QUERCUS INFECTORIA, *Olivier.*

N. Ord. CUPULIFERÆ.

Tribe

Genus Quercus, *Linn.*

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249. Quercus infectoria, *Olivier, Voy. dans l'Emp. Oth.*, ii, p. 64 (1800).

Syn.—Q. lusitanica, var. infectoria, *A. DC.* Q. rigida, *C. Koch.* Q. petiolaris, *Boiss.*

Figures.—Steph. & Ch., t. 152; Woodville, vol. v; Olivier, Voy. dans l'Empire Othoman, Atlas, tt. 14, 15, cop. in Nees, t. 94, and Hayne, xii, t. 45; B. & S., t. 296.

Description.—A shrub or rarely a small tree, erect, with irregular spreading branches, bark brownish-grey, the young twigs usually woolly or downy. Leaves alternate, stalked, the petioles varying from very short to ¾ inch long, blade usually 2—3 inches long, broadly oval- or obovate-oblong, rounded at both ends, rather shallowly cut into large, acute or obtuse rounded teeth or lobes, stiff and thick, smooth above, usually with minute scattered stellate hairs chiefly on the nerves beneath; stipules as in *Q. Robur*. Flowers as in the last, but the male catkins shorter, with the axis more hairy, the perianth in 4—7 divisions. Fruit much as in *Q. Robur*, sessile or stalked, the cup deeper, slightly constricted at the mouth, the scales very much adpressed, ovate-lanceolate, covered with a dense grey tomentum, the glans usually somewhat longer and narrower, reaching as much as 1½ inch in length.

Habitat.—This kind of Oak grows in many parts of Asia Minor abundantly, especially in Syria; the same form occurs in Greece, Southern Turkey, and Cyprus. Though we have for the sake of distinction retained Olivier's specific name, we cannot regard *Q. infectoria* as other than a form of the very variable *Q. lusitanica* under which indeed all recent writers place it, and which in one or other of its varieties (twelve are enumerated by De Candolle) ranges through Spain and Portugal, and extends throughout the Mediterranean region. It is almost as polymorphic as *Q. Robur*,

from which it is chiefly distinguished by its smaller size, less indented leaves and longer acorn, with a rather differently-shaped cup. The leaves vary from small, subspinous, and oval to almost entire and rounded; the amount of hair on the under surface is also very variable. It is in cultivation at Kew with other species.

The flowers appear in May and the fruit is ripe in September, the foliage is persistent till the spring, or sometimes even longer.

There seems no doubt that the bulk of the best Aleppo or Turkey galls are the production of this kind of oak, but other varieties of *Q. lusitanica* as well as allied species also afford them.

Webb, Iter Hispan., p. 11; A. DC., in DC. Prod., xvi, 2, p. 17; Willk. & Lange, Fl. Hisp.; Lindl., Fl. Med., p. 291; Flück. and Hanb., Pharmacogr., p. 536.

Official Part and Name.—Galla; excrescences on Quercus infectoria, *Olivier*, caused by the punctures and deposited ova of Diplolepis Gallæ tinctoriæ, *Latr.* (B. P.). Excrescences caused by the punctures and deposited ova of Diplolepis Gallæ tinctoriæ (I. P.). Galla; a morbid excrescence on Quercus infectoria (U. S. P.).

Production.—Galls are morbid excrescences or tumours, formed of hypertrophied vegetable tissues, the result of their puncture by the horny ovipositors of female Hymenopterous insects and the deposit in them of an egg or eggs. In the present case the insect is the *Cynips Gallæ-tinctoriæ*, Olivier (beautifully figured by C. Curtis in Steph. and Church., t. 152), the female of which deposits her eggs in the young leaf-buds; these latter then undergo great enlargement, and ultimately form the galls. On a section of one of these galls there is found a soft somewhat spongy tissue in which are several scattered vascular bundles; the exact centre being occupied by the ovum which is surrounded by very juicy tissue the cells of which contain starch. It is not until the gall has attained its full development that the egg is hatched and the larva or grub commences to feed on the juices of the central tissue; the cavity of the gall is never more than just

large enough to contain the larva, and soon becomes lined with a wall of hard cells, the tissue of the whole gall gradually becoming harder. As soon as the grub has reached its full development it passes into the pupa or chrysalis stage, and in process of time is transformed into a small four-winged fly about $\frac{1}{4}$ inch in length; this cuts with its mandibles a passage to the surface and escapes by a circular orifice near the middle of the gall. Hence if we examine those galls from which the insect has thus escaped we observe externally a small round hole leading to a cylindrical canal which passes to the centre of the gall; but on those galls from which the insect has not escaped we find no opening externally.

Varieties and Commerce.—There are several varieties of oak galls, which vary much in size, shape, weight, character of surface, and other particulars; but the ordinary galls of commerce are known as *Aleppo, Turkey,* or *Levant Galls,* and will be alone described. Formerly these galls, or nutgalls as they are also termed, formed a very important commercial product from the province of Aleppo, but of late years, in consequence of the increased use of some other dyeing and tanning substances, the trade in nutgalls has considerably declined. These galls are exported from Trebizond, and from Smyrna, Bassorah, and other Turkish ports.*

General Characters and Composition.—In commerce two kinds of Aleppo galls are distinguished, namely, *blue* or *green galls,* and *white galls,* the former of which are the most esteemed, and are alone official. *Blue* or *green galls,* or, as they are sometimes called, *black galls,* are those which are gathered before the insect has escaped, and are consequently imperforate. They are hard, heavy, globular bodies, varying in diameter from nearly half an inch to about three quarters of an inch or more; they are somewhat tuberculated on their surface, the tubercles and the intervening

* The insect which forms the common hard gall of English oaks is *Cynips Kollari,* Giraud, for description of which, and of other British species, reference may be made to the Rev. T. A. Marshall's papers in the Entomologists' Monthly Mag., iv (1867), pp. 6, and seq.

spaces being usually smooth; they have a dark blueish-green or olive-green colour externally, and are yellowish or brownish white within, and have a small cavity in their centre, in which may be found the remains of the larva or the more or less developed insect, according to the period at which the galls have been gathered. They have no odour, but an intensely astringent and somewhat acidulous taste, which is ultimately followed by some degree of sweetness. *White galls* are those from which the fly has escaped, hence they are perforated from the surface to the central cavity (which is here sometimes as much as a quarter of an inch in diameter) by a small circular canal. They are larger than the blue galls, lighter coloured, being pale yellowish brown, less compact, less heavy, and are not so astringent; they are of inferior value.

The most important constituent of nutgalls is that kind of tannic acid which from having been first distinguished in them is called *gallo-tannic acid.* The best galls yield from 60 to 70 per cent. of this tannic acid, although in some cases not more than about 30 per cent. is obtained. Galls also contain 3 or more per cent. of *gallic acid,* together with *sugar, resin,* and other unimportant substances. Infusion of galls reddens litmus paper, forms an inky compound on the addition of a persalt of iron, and a yellowish-white precipitate with a solution of gelatine.

Medical Properties and Uses.—Galls are the most powerful of known vegetable astringents, hence they are applicable in all cases where astringent medicines are required. In their crude state they are, however, but little used, except externally, but the official tannic and gallic acids which are obtained from them, are much more largely employed medicinally. In the form of decoction or when powdered, galls have been recommended as an antidote in poisoning by emetia and the vegetable alkaloids generally; also in that of those vegetable products as opium, colchicum, nux vomica, &c., the activity of which depends on an alkaloid; and in poisoning by tartarated antimony. The powers of galls, however, as an antidote, require further investigation. The official tincture of galls when diluted with water forms a

very useful and convenient astringent gargle and wash; and the official ointment of galls, and the ointment of galls with opium, more especially the latter, are valuable applications to hæmorrhoids after the inflammatory stage has passed. The diluted tincture or ointment of galls may be also employed to give tone to, and lessen discharges from, mucous membranes, as in gleet, leucorrhœa, &c.

The tincture of galls is also used as a test for the alkaloids, gelatine, and the persalts of iron. If kept, however, for some time, it no longer forms precipitates with solutions of gelatine and the vegetable alkaloids, as its tannic acid becomes by keeping converted into gallic acid; it still, however, serves to detect iron salts.

The principal use of galls is for the preparation of the official tannic and gallic acids; for dyeing and tanning purposes; for the preparation of ink; and for other purposes in the arts.

Per. Mat. Med., vol. ii, pt. 1, p. 343; Per. Mat. Med., by B. & R., p. 493; Pharmacographia, p. 536; U. S. Disp., by W. & B., p. 415; Guibourt, Hist. des Drogues, vol. ii (1869), p. 292; Lacaze-Duthiers in Ann. Sci. Nat., ser. 3, vol. xix (1853), p. 273, with 4 plates, and Pharm. Journ., ser. 1, vol. xiii, p. 16; Prillieux in Ann. Sci. Nat., ser. 6, vol. iii (1876), p. 113; Gmelin's Chemistry, vol. xv (1862), p. 449; Watts' Dict. Chem., vol. ii, p. 762; Schorlemmer, Chemistry of the Carbon Compounds, 1874, p. 463; Garr., Mat. Med., p. 355.

DESCRIPTION OF PLATE.

Drawn from specimens collected in Asia Minor by P. Russell, Kotschy, and Balansa, in the British Museum.

1. Young branch with male catkins.
2. Male flower.
3. Anthers.
4. Section of the same.
5. Branch in fruit with a gall.
6. Section of glans.
7. Seed, with one cotyledon removed.
8. Section of a gall.

(2–4 enlarged.)

QUERCUS ALBA. *Linn.*

M & N. Hanhart imp.

N. Ord. CUPULIFERÆ.
Tribe *Quercineæ*.
Genus Quercus, *Linn.*

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250. Quercus alba, *Linn., Sp. Plant., ed.* 1, *p.* 996 (1753).

White Oak. Valley Oak.

Figures.—Michaux, Hist. Chênes de l'Amerique, t. 5; Michaux f., N. American Sylva, i, t. 1; Brendel, Oaks of Illinois, t. 29.

Description.—A large tree reaching 80 feet in height, with many long, wide-spreading branches; bark pale or white, often marked with large black spots, young twigs glabrous. Leaves stalked, the petiole varying from $\frac{1}{4}$—$\frac{3}{4}$ inch in length, 3—6 inches long, oval- or obovate-oblong, tapering at the base, more or less deeply pinnatifid, with few (4—6) ascending, obtuse, rounded, entire lobes, smooth on both surfaces when mature, thickly downy when young, bright light green above, glaucous and with the veins prominent beneath; stipules linear, pubescent, caducous. Male catkins 1—3 inches long, slender, the rachis nearly glabrous; the perianth irregularly cut into 4—6 lobes; stamens 8. Fruit solitary or 2 together at the extremity of a stout peduncle, which varies in length from nearly an inch to scarcely a line, cup broadly hemispherical, rather shallow, grey, the scales ovate, acute, hard, becoming tubercular, strongly imbricate, pubescent; nut about an inch long, twice or thrice as long as the cup, ovoid.

Habitat.—This fine tree is found over a very large extent of North America, extending from the Red River, Lake Winnipeg, and Maine, in the north, to Texas and Florida in the south. It is especially abundant in the State of Pennsylvania and Virginia, and grows by preference in rather moist ground. In England it is occasionally planted, having been first grown here in 1724.

It is of all the American oaks the kind most like the British species (*Q. Robur*), and, like it, presents much variability in the length of the petioles and of the stalks supporting the acorns;

there is also much range in the depth of the lobes of the leaves, and a form is described with a very small acorn.

The flowers appear in spring, as in other oaks, and the acorns fall in October. The leaves in autumn acquire a bright violet colour.

Michaux, N. American Sylva, i, p. 8; A. Gray, Man. Bot. N. U. States, p. 450; Chapman, Fl. South. States, p. 423; A. DC. in DC. Prod., xvi, pt. 2, p. 22; Hook., Fl. Bot.-Amer., i, p. 258.

Official Part and Name.—QUERCUS ALBA; the inner bark (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India. The bark of *Quercus pedunculata* is alone recognised in the two latter pharmacopœias; it is described under *Quercus Robur*.

Collection.—For medicinal and other purposes this bark should be gathered in the spring, as at this season it contains most astringent matters. When gathered, the outer layers of the bark should be removed, and the inner bark dried. The bark of the young stem and small branches is to be preferred.

General Characters and Composition.—White Oak bark, when divested of its outer layers, in which state it is alone official, has a light brown or somewhat reddish-brown colour, a coarse fibrous texture, so that it is powdered with difficulty, a feeble tan-like odour, and an astringent, bitter taste.

Its chief ingredients are *tannic acid* and *gallic acid*. Its properties, which are extracted both by water and alcohol, are essentially due to tannic acid, and as this is most abundant in the spring, as already mentioned, the bark is most active at this season of the year. The kind of tannic acid it contains is probably the same as that found in our official oak bark, which we have referred to under *Quercus Robur*. It probably also contains the substance called *quercin*.

Medical Properties and Uses.—White Oak bark possesses similar properties, and is used for like purposes as the official Oak bark of the British Pharmacopœia; these are therefore described under *Quercus Robur*. In the United States, white oak bark is preferred for medicinal purposes to the bark of the

Quercus tinctoria, which is there also official; this is described after that of the present species.

Besides its use in medicine white oak bark is also employed in tanning; and the timber of this tree is highly valued in the United States. It is used in shipbuilding, and by wheelwrights, coopers, and others.

U. S. Disp., by W. & B., p. 722; Wood, Therap. & Pharm., vol. i, p. 117; Stillé, Therap. & Mat. Med., vol. i, p. 216; Per. Mat. Med., vol. ii, pt. 1, p. 360; Gerber, Archiv der Pharm., vol. xxxiv, p. 167.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum.

1. A branch with full-grown leaves and ripe fruit.
2. An acorn.
3. Embryo.

1
2
3
4
5
6

N. Ord. CUPULIFERÆ.

Tribe *Quercineæ*.

Genus Quercus, *Linn.*

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251. Quercus tinctoria, *Bartram, Travels, p.* 37 (1791).

Black Oak. Yellow-Barked Oak. Quercitron.

Syn.—Q. coccinea, var., *DC.* Q. ambigua, *Mich. fil.* Q. discolor, *Willd.?*

Figures.—Michaux, Hist. Chênes de l'Amer., t. 24, cop. in Hayne, xii, t. 46; Michaux, f., N. American Sylva, i, t. 24; Ib., t. 25 (*Q. coccinea*), and t. 26 (*Q. ambigua*).

Description.—A large tree of 80 or 90 feet high, the bark thick, rough, dark grey or black externally, yellow or orange within, young branches smooth. Leaves on slender petioles which are ½—1 inch long, spreading, 3—6 inches long, oval or somewhat obovate in outline, abrupt at the base, acute at the apex, more or less deeply pinnatifid, with few, spreading, acute, triangular segments each tipped with a hair-like bristle and often sparingly toothed, membranous, bright green, smooth and shining above, paler, glabrous or slightly pubescent beneath when mature, strongly pubescent when young. Male catkins long, slender; perianth 2—5-parted; stamens 3—5. Fruit in clusters of 2 or 3 on the wood of the previous year, sessile or nearly so; cup hemispherical or somewhat top-shaped with a conical base, the scales laxly adpressed, velvety, nut small, ½—¾ inch long, globular-ovoid, often apiculate, not more than as long again as the cup.

Habitat.—The Black Oak is found throughout the United States of America, and is able to grow on poorer soil than *Q. alba.* It is especially abundant in the Middle States, and is rare in the North-eastern ones. The acorns are not ripe till the autumn of the second year. This tree is grown in English Arboretums.

The name *Q. tinctoria,* published by Bartram without any description, has been adopted here without the intention of claiming for the form specific rank. Botanists, who have made a study of the puzzling varieties of the American oaks, are agreed in placing the name as

that of one of the numerous forms of *Q. coccinea*, Wang., the Scarlet Oak, from the typical form of which it differs in its less deeply-cut leaves, less top-shaped cup to the fruit, and the dark thick bark. The foliage also in the autumn, instead of turning bright red (as the name of the Scarlet Oak indicates), becomes dull red, orange, or brownish. Another variety, the Grey Oak, *Q. ambigua*, Mich. f., which is found in the North-eastern States and Canada, has a longer acorn.

A. Gray, Man. Fl. N. U. States, p. 454; Hook., Fl. Bor.-Amer., ii, p. 158; A. DC. in DC. Prod., xvi, pt. 2, p. 61; Mich. f., N. American Sylva, i, p. 46; Chapman, Fl. South. States, p. 422.

Official Part and Name.—QUERCUS TINCTORIA; the inner bark (U. S. P.). It is distinguished as Black Oak Bark. It is not official in the British Pharmacopœia, or the Pharmacopœia of India, for, as already noticed in describing *Quercus Robur* and *Quercus alba*, the inner bark of the latter plant and that of the present species is used in the United States as a substitute for that of the official plant of the British Pharmacopœia and of the Pharmacopœia of India.

Collection.—It should be collected at the same period of the year, and prepared for use in like manner, as the bark of *Quercus alba*, already described.

General Characters and Composition.—The bark of this species, when entire, has a black or dark brown colour, hence its common name of *black oak bark*. When obtained from the trunk it is thick, and marked externally with fissures and furrows; internally it has a deep reddish-brown colour when dried. The bark of the small branches and young stem, like that of similar parts of our common oak, is smoother than that of the trunk; it is also more active than it. The inner bark is alone official. This has a deep reddish-brown colour, fibrous texture, rough fracture, strong odour, bitter astringent taste, and when chewed it tinges the saliva yellow. It is readily distinguished from white oak bark by its more bitter taste, and by the yellow colour it communicates to the saliva when chewed. When deprived of its external rough portion and reduced to shreds, or a coarse powder, it is larger exported from

the United States to Europe, under the name of *quercitron bark.*

Besides *tannic acid* and *gallic acid,* to which its medicinal properties are due, but more especially to the former, it also contains a peculiar colouring principle, termed *quercitrin,* which renders it valuable as a dye-stuff. *Quercitrin* is a yellow crystallizable substance, which has been usually regarded as a glucoside, under the assumption that by the action of acids it was split into glucose and quercetrin, but it has been recently found by Löwe not to be a glucoside. Quercitrin is soluble in solutions of the caustic alkalies with the production of a golden-yellow colour.

Medical Properties and Uses.—The medical properties and uses are the same as our official oak bark and of white oak bark, and are described under *Quercus Robur* and *Quercus alba.* It is said to be more tonic in its action than that of white oak bark, but usually it is considered in the United States as inferior to that bark, in consequence of its greater disposition to irritate the bowels.

Quercitron bark is sometimes employed for tanning, but it is less used than the other oak barks for that purpose, in consequence of the colour it imparts to leather. It is chiefly used in Europe for dyeing silk and wool of a yellow colour.

U. S. Disp., by W. & B., p. 724; Wood, Therap. and Pharmacol., vol. i, p. 117; Stillé, Therap. and Mat. Med., vol. i, p. 216; Watts, Dict. Chem., vol. v, p. 6; Per Mat. Med., vol. ii, pt. 1, p. 360; Proc. Amer. Pharm. Assoc. for 1876, vol. xxiv, p. 370, from Zeitschr. Anal. Ch., Nos. 3 & 4, 1875, p. 233; Amer. Journ. Pharm., May, 1860, p. 222.

DESCRIPTION OF PLATE.

Drawn from Canadian specimens in the British Museum, collected by Douglas.

1. Young twig with male and female inflorescence.
2. Male flowers.
3. Female flowers.
4. Vertical section of female flower.
5. Branch with fully grown leaves and ripe fruit.
6. An acorn.

(2–4 enlarged.)

D.Blair ad nat. del.et lith.

M & N.Hanhart imp

SANTALUM ALBUM, *Linn.*

N. Ord. SANTALACEÆ. Lindl., Veg. K., p. 787; Le Maout & Dec., p. 722.

Genus Santalum,* *Linn.* DC. Prod., xiv, pp. 681—686. About 20 species are known, natives of Australia, the Pacific Islands, and India.

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252. Santalum album, *Linn., Sp. Plant., ed.* 1, *p.* 349 (1753).

Sandal Wood. Yellow (or white) Sanders Wood. Chandan; Chandal (India).

Syn.—Syrium myrtifolium, *Roxb.*

Figures.—Woodville, t. 99 (drawn from a specimen in Herb. Banks); Hayne, x, t. 1; Nees, t. 127; Rumph., Herb. Amboin., ii, t. 11; Bot. Mag., t. 3235; Roxburgh, Coromandel Pl., t. 2; Beddome, Fl. Sylv., t. 256.

Description.—A small tree, 20—30 feet high, with numerous, opposite, slender, drooping branches; bark rather smooth, grey-brown; young twigs glabrous. Leaves opposite, without stipules; petiole slender, about ½ inch long; blade 1½—2½ inches long, oval, ovate-oval or lanceolate, acute or obtuse at the apex, tapering at the base into the petiole, entire, smooth on both sides, glaucous beneath. Flowers small, numerous, shortly stalked, in small, pyramidal, erect, terminal and axillary, trichotomous, paniculate cymes, panicle-branches smooth, bracts small, but passing into the leaves below. Perianth campanulate, smooth, about ⅕ inch long, divided into 4 (rarely 5) triangular, acute, spreading segments, valvate in the bud, rather fleshy, at first straw coloured, afterwards changing into deep reddish-purple, provided at the mouth with 4 erect, fleshy, rounded lobes (staminodes ?). Stamens 4, opposite the perianth-segments; filaments very short, inserted in the mouth of the perianth and alternating with the erect lobes; anthers short, 2-celled, introrse. Ovary half-inferior, tapering, 1-celled, with an erect central placenta rising from the base and not reaching the top, to the

* *Santalum, σάνταλον*, the classical name; from the Sanskrit *Chandana* (see also no. 82, *Pterocarpus santalinus*). The word *Sandal* is Arabic.

removed in the manner described above; but in rare cases the bark has been alone separated from the wood beneath. These billets vary usually in length from 2 to 4 feet, and in diameter from 3 to 8 inches; they are somewhat cylindrical in form, and very heavy. When the sap wood has been removed, the colour of a transverse section of the heart wood is yellowish-brown, with darker coloured concentric zones; the odour when rubbed or ground is very agreeable, approaching to that of the rose, and very persistent; and the taste strong, aromatic, and bitterish. The sap wood is whitish, and almost odourless and tasteless.

The most important constituent of sandal wood is an essential oil, which is procured from the heart wood after it is cut into small chips, by distillation with water. Flückiger and Hanbury state the yield at about 1 per cent.; but Dr. G. Bidie gives it at 2·5 per cent. The latter observer also says, that the roots yield the largest quantity, and the finest quality, of oil. This oil is a transparent, thick, pale yellow liquid; varying in specific gravity, according to different experimenters, of from 0·963 to 0·980; and having the odour of the wood. The quality of the oil varies much according to the wood from which it has been derived. The other constituents of sandal wood have not been specially examined.

Other Kinds of Sandal Wood and Commerce.—Besides the sandal wood described above from *Santalum album*, other sorts of sandal wood are also derived from species of *Santalum*; thus, in the Sandwich Islands, from *Santalum Freycinetianum*, Gaud. and *S. pyrularium*, A. Gray; in the Fiji Islands from *S. Yasi*, Seem.; in Western Australia from *S. spicatum*, DC., and *S. cygnorum*, Miq. (*Fusanus spicatus*, Br.); and in New Caledonia from *S. austro-caledonicum*, Vieill. The supplies from these districts are, however, uncertain, as no care is taken in preserving the trees; and, indeed, in some cases, appear to be no longer found in commerce.

The different kinds of sandal wood also vary much in quality; and fetch various prices. In the commercial houses of China three kinds are specially mentioned, namely, South Sea Island, Timor, and Malabar. The latter, which is the one

we have particularly described, being three or four times the value of either of the other varieties. In China alone, the quantity of all kinds of sandal wood imported, averages over 5000 tons, representing a value of not less than £100,000.

Medical Properties and Uses.—Sandal wood has long had a reputation in the East, as a remedy in fevers, indigestion, palpitations, and many other affections. At the present day, the powdered wood, made into a paste with water, is a common application in India amongst the natives, in inflammatory affections, and in skin diseases, &c. The volatile oil has also lately been recommended as a remedy in gonorrhœa, by Dr. T. B. Henderson, of Glasgow. He regards it "as equal, and frequently superior, to Copaiba and Cubebs, having found it sometimes to succeed when both these remedies had previously failed. Its comparatively pleasant taste and smell also give it a great advantage over Copaiba."

The principal use of sandal wood is not, however, for medicinal purposes, but for consumption as incense in the Chinese temples; and in India in the celebration of sepulchral rites, where pieces of sandal wood are placed by the wealthy Hindoos in the funereal pile. Sandal wood is also largely used in India, &c., by cabinet makers, in the manufacture of caskets, jewel-boxes, deed-cases, &c.; and likewise, to some extent, as a perfume.

The oil of sandal wood is also greatly esteemed as a perfume, and is much employed by perfumers in this country and elsewhere wherever it can be obtained.

Gerarde's Herball., by Johnson (1636), p. 1585; Woodville's Med. Bot. (Supplement), 1794, p. 136; Miller's Gard. Dict., vol. ii, pt. ii; Pharmacographia, p. 540; U. S. Disp., by W. and B., p. 1689; Milburn, Oriental Commerce (1813), vol. i, p. 291; Pharmacopœia of India, pp. 197 and 461; Piesse, Art of Perfumery, 3rd ed., 138; Pharm. Journ., ser. iii, vol. i, p. 938; Henderson, in Med. Times and Gaz., June, 1865, p. 571.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum collected at Tranquebar; the fruit added from Henfrey.

1. A flowering branch.
2. A flower.
3. Perianth laid open.
4. Vertical section of the flower.
5. Transverse section of ovary.
6. Fruit.
7. Vertical section of the same.
8. Embryo.

(2–8 enlarged.)

[By an oversight the artist has represented the perianth as 5-lobed in figs 1 and 2; in 3 and 4 it is correctly drawn 4-lobed.]

D.Blair ad nat. del. et lith.

M&N.Hanhart imp.

TAXUS BACCATA, *Linn.*

N. Ord. Coniferæ. Le Maout & Dec., p. 739.

Tribe *Taxineæ*. Lindl., Veg. K., p. 230 (N. Ord.).

Genus **Taxus**,* *Linn.* Parlatore, in DC. Prod., xvi, 2, p. 499. Species 6, natives of temperate parts of the northern hemisphere.

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253. Taxus baccata, *Linn., Sp. Plant., ed.* 1, *p.* 1040 (1753).

Yew.

Icon.—Nees, t. 88; Richard, Comm. de Conif., t. 2; Schnitzlein, Iconog., t. 78; Syme, E. Bot., viii, t. 1384; Reichenb., Ic. Fl. Germ., xi, t. 538; Nees, Gen. Fl. Germ.

Description.—An evergreen tree, usually 20—30 feet high, but sometimes much taller, with a very large and thick trunk and widely-spreading horizontal branches, bark dark-brown, furrowed, shredding off in fibres, young twigs green. Leaves very numerous and closely placed, alternate, with a very short petiole which is continued as a raised band down the stem, articulated, ½—1 inch long, somewhat curved, linear-strap-shaped, sharp-pointed but not prickly, entire, rather thick, dark shining green above, pale beneath, midrib prominent, all pointing somewhat upwards right and left by a twist in the petioles; buds very small, axillary, clothed with little scales. Flowers diœcious; the male in catkins, the female in cones; all axillary. Male catkins ovoid, scarcely ¼ inch wide, consisting of a rather thick axis with several closely placed, thin, imbricated, yellowish gradually diminishing scales on its lower half, and on its upper half about 10—20 closely placed nearly sessile sulphur-yellow anthers, forming a subglobular head; anther-connective peltate, lobed, with 4—7 cells attached to its under surface, and dehiscing longitudinally, pollen globose. Female cones reduced to very small bud-like bodies consisting of several rows of small, imbricated scales surrounding a single, terminal, erect, urceolate ovule, with a small annular "aril" at its base, coat of the ovule prolonged above into a nipple-shaped tube which projects beyond the topmost bracts of the cone.

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* *Taxus*, the classical name.

Fruit (galbulus) consisting of a small seed ("nut"), closely surrounded and covered except at the summit by the greatly enlarged "aril" which has become a berry-like fleshy cup, the whole supported on a small circular base formed of the cone-scales, from which the "berry" is readily separated; cup somewhat exceeding the nut, with a sharp edge above, skin thin but strong, coral-red, filled with a thick, glutinous, nearly colourless juice; "nut" loosely attached to the axis by a broad base, about ¼ inch long, roundish ovoid, bluntly pointed and obtusely 3 or 4 angled above, dark ruddy brown, smooth, minutely pitted under a lens, covered with a thin papery pale brown skin and a very thin layer of brown semifluid pulp, inner coat hard, bony, pale yellow; embryo small straight, with 2 short cotyledons and a superior radicle, lying in the axis of the tough endosperm.

Habitat.—The yew is chiefly familiar as a planted tree, especially in churchyards, but it grows wild in many parts of England, principally on chalk and limestone, where it sometimes forms small woods or groves. On the chalk downs of the southern counties are found trees of undoubtedly very great antiquity. It is a native of the whole of Central and Southern Europe, and extends to North Africa, Asia Minor, the Amur district to the Himalaya, ascending in Sikkim to an elevation of 7000—10,000 feet. There are many garden varieties cultivated, of which the best known are *T. fastigiata,* Lindl., with an upright pyramidal habit of growth, and *T. hibernica,* Mack., with yellow "berries." Some botanists consider that there is but one kind of yew, and that the American and Japanese species should all be referred to *T. baccata.*

What are above described as anthers are perhaps better considered to be antheriferous bracts, and the anther-cells as anthers. Some authors describe the stamens as monadelphous.

Syme, E. Bot., viii, p. 276; Hook. f., Stud. Fl., p. 348; Watson, Comp. Cyb. Brit., p. 320; Loudon, Arb. et Frut. Brit., iv, p. 2066; Parlatore, l. c., p. 500.

Parts Used and Names.—Taxus, *Yew;* the leaves and fruits.

It is not official in the British Pharmacopœia, or the Pharmacopœia of India, or the Pharmacopœia of the United States.

General Characters and Composition.—The leaves have an acrid, bitter, disagreeable taste, and an unpleasant odour. The red succulent cup of the fruit has a sickly taste, but it is, however, frequently eaten by children, and also by birds, wasps, &c.; it has no marked odour.

The leaves contain a *volatile oil, tannic* and *gallic acids,* and a resinous substance called *taxin.* Two pounds of the leaves, according to Lucas, yield about 3 grains of taxin. This substance is but little soluble in water, but readily so in alcohol, ether, and dilute acids. The active properties of yew are probably due to the taxin and volatile oil, but on this point we have no positive evidence.

Medical Properties and Uses.—Yew leaves and fruits have been given for their emmenagogue, sedative, and antispasmodic effects. Pereira says that therapeutically the yew appears to hold an intermediate position between savin and digitalis, being allied to the former by its acrid, diuretic, and emmenagogue properties, and to the latter by the giddiness, irregular and depressed action of the heart, convulsions, and insensibility, which it produces. Yew is, however, reported to have one decided advantage over digitalis by its effects not accumulating in the system; so that it is a much more manageable remedy than it. Besides its use as an emmenagogue and sedative in the same cases as savin and digitalis are administered, it has also been employed as a lithic in calculous complaints; and as an antispasmodic in epilepsy and convulsions. According to Dr. Taylor, yew-tree tea is sometimes used by ignorant persons to cause abortion. At the present time, however, yew is never used in regular medical practice, the principal interest attached to it having reference to its poisonous properties. Thus the leaves and young branches act as a narcotico-acrid poison, both to the human subject and some other animals, but more especially to horses and cows. Fatal cases of poisoning have also occurred from swallowing the fruit. It is frequently stated that animals may feed upon the young growing

shoots with impunity, but that when these have been cut off, and left upon the ground for a short time, they are then poisonous. This is, however, an entirely erroneous notion, for yew shoots and leaves are poisonous both in a dried and fresh state. It seems certain, however, that the red succulent cup of the fruit is harmless, for a fatal case of poisoning has been recorded of a child from swallowing the entire fruit with its contained seed; whilst other children who had partaken of the fruit at the same time, but who had rejected all but the fleshy cup, suffered no ill effects.

Per. Mat. Med., vol. ii, pt. 1, p. 334; Lind., Flora Medica, p. 558; Bentl., Man. Bot., p. 646; Miller, Gard. Dict., vol. ii, pt. 2nd; Watts, Dict. Chem., vol. v, p. 702; Lancet, Oct. 17, 1868, p. 530; Pharm. Journ., vol. i, 2nd ser., p. 294, and vol. vi, p. 489.

DESCRIPTION OF PLATE.

Drawn from trees in Kew Gardens; the female flower copied from Nees.

1. Twig of male plant with catkins.
2. A catkin.
3. Vertical section of the same.
4. The same after the pollen is shed.
5. The connective.
6. An anther.
7. Small branch of female tree with fruit.
8. A female inflorescence.
9. The ovule.
10. Section of the same.
11. Half ripe fruit.
12. Ripe fruit.
13. Same with half the "aril" removed.
14. Section of seed.
15. Insertion of the leaves.

(2–6, 8–10, 14, 15 enlarged.)

D.Blair F.L.S. ad sicc. del. et lith.

M & N. Hanhart imp.

JUNIPERUS SABINA, *Linn.*

N. Ord. Coniferæ.

Tribe *Cupresseæ*.

Genus Juniperus,* *Linn.* Parlatore, in DC. Prod., xvi, pt. 2, pp. 475—493. Species 27, natives of temperate and cold regions of the northern hemisphere.

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254. Juniperus Sabina,† *Linn., Sp. Plant., ed.* 1, *p.* 1039 (1753).

Savin.

Syn.—J. fœtida, *Spach.* J. lycia, *Pallas.* J. prostrata, *Pers.*

Figures.—Woodville, tt. 5 & (*J. lycia*) 7; Nees, t. 87; Berg & Sch., t. 30 a; Pallas, Ic. Fl. Rossicæ, ii, t. 56; Reichenb., Ic. Fl. Germ., xi, t. 536.

Description.—A small or large bush (occasionally even becoming a small tree), usually very compact and spreading horizontally, with very numerous, slender, much divided branches, bark pale reddish-brown, scaling off. Leaves opposite or in threes, closely placed, small, numerous, evergreen, and very persistent, glabrous, of two forms, those on the elongated branchlets more distantly placed, triangular-subulate, adnate to the axis or decurrent for the greater part of their length, free and spreading at the apex, those on the smaller lateral shoots rhomboidal and scale-like, closely imbricate, and wholly adpressed, subacute at the apex, with a large oval gland in the centre. Flowers unisexual, dicœcious, very small, the male in catkins, the female in small cones, both situated at the extremity of short lateral branches, erect in the male, recurved in the female. Male catkins as in *J. communis*. Female cones consisting of several overlapping, broad, thick, empty scales below, and 4 (rarely 6) very broad, thick, fleshy, spreading ones above, decussately arranged in pairs. Ovules minute, flask-shaped, 1 to 4, arranged solitarily or in pairs in the axils of the lower pair of thickened scales. Fruit berry-like, formed by the enlargement and coalescence of

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* *Juniperus*, the classical name (in Greek ἄρκευθος) for *J. communis*.

† *Sabina*, the Latin name for the plant; the Greek was βράθυ.

the thick scales, the points of which are still visible, about the size of a pea, on short, curved, nodding stalks, spherical, dark blueish purple with a whitish bloom, soft, enclosing 1 to 3 seeds. Seed somewhat variable in form, usually ovoid, compressed, with two or three large "glands" running down the surface, testa very hard, rough; embryo straight in axis of the endosperm, radicle superior.

Habitat.—The Savin is found through a large portion of the colder temperate regions of the northern hemisphere. It is an Alpine species in Central and Southern Europe, growing in the mountain regions of Switzerland, Germany, France, Austria, Spain, Italy, and Greece, but not extending into Scandinavia, or the British Islands; in the Alps it grows to an elevation of 5000 feet. In Asia this shrub is is found in the Caucasus, where it reaches to 12,000 feet, the Caspian districts, the Altai, and the whole of Siberia, and in America it occurs in Newfoundland and on the borders of Canada and the United States.

As might be expected from this extensive range, it is a variable species. In the colder regions it is a small, depressed, spreading bush or even (var. *procumbens*) a prostrate or creeping one, but in more favorable localities it becomes a good-sized shrub. Sir. W. J. Hooker and Hanbury, indeed, have considered the Red Cedar of the United States, *J. virginiana*, L., which not unfrequently in the west reaches a height of 80 feet, to be the same species. It differs chiefly in habit, in the rather smaller erect fruit, and in the leaves being somewhat more acute. There is a figure in Bigelow, t. 45.

Savin was grown in English gardens in the middle of the 16th century, and was formerly much more frequently cultivated than is now the case. It flowers in May and June.

Gren. & Godr., Fl. France, iii, p. 159; Willk. and Lange, Prod. Fl. Hisp., i, p. 21; Parlatore, in DC. Prod., xvi, pt. 2, p. 483; Ledebour, Fl. Ross., iii, p. 682; Hook., Fl. Bor.-Amer., ii, p. 166; A. Gray, Man. Bot. North U. S., p. 474; Lindl., Fl. Med., p. 557.

Official Parts and Names.—1. Sabinæ Cacumina; the fresh and dried tops: 2. Oleum Sabinæ; the oil distilled in Britain from

fresh savin (B. P.). 1. The fresh and dried tops: 2. The volatile oil obtained by distillation from the fresh tops (I. P.). Sabina; the tops (U. S. P.).

1. Sabinæ Cacumina, or Sabina.—*Collection, General Characters, and Composition.*—For medicinal purposes *savin* or *savine tops* should be collected in the spring, and the young green shoots should be separated from the hard woody branches from which they arise. When thus obtained, the twigs are densely covered with minute, imbricated, adpressed, dark green leaves. When rubbed or bruised they have a strong, peculiar odour, which is generally regarded as unpleasant; and a bitter, acrid, disagreeable taste.

The dried tops are yellowish-green, and have less odour than the fresh ones. When in very coarse powder, or in fragments, the microscope shows the presence of the bordered pits so characteristic of the wood-cells of the Gymnospermia; and as savin is sometimes given for criminal purposes, the microscope may afford important aid in detecting it under such circumstances.

The essential constituent of savin is the official *volatile oil*, which is described below. It also contains *resin, tannic acid,* and other substances of no importance.

Medical Properties and Uses.—Savin, both when administered internally, or locally applied, is an irritant; its effects are most manifest upon the uterus, hence it is a powerful emmenagogue. In large doses it is an energetic poison, producing gastro-enteritis, collapse, and death. It is said to be serviceable in amenorrhœa and chlorosis, when unattended with congestion of any of the pelvic viscera. It should not be given in pregnancy, as it is a powerful abortifacient; hence in large doses, it has often been given criminally to produce abortion, and has not unfrequently, in such cases, caused the death both of mother and child. It is rarely administered internally; but is frequently used externally in the form of the official ointment, as a dressing to blisters when it is desired to keep up the discharge, and also as an application to issues and setons to promote their discharge.

Savin is likewise applied externally to syphilitic warts, and in psora and other skin diseases.

2. Oleum Sabinæ.—*General Characters.*—Oil of Savin is directed to be distilled from the fresh tops, which yield from 2 to 3 per cent. This oil is colourless or pale yellow, limpid, with the characteristic odour of the plant, and a bitter, extremely acrid taste. It is dextrogyrate, its specific gravity is 0·915, boiling point 315°, and its composition is the same as that of oil of turpentine. It is but moderately soluble in alcohol, but freely so in ether. Oil of Savin is official in the British Pharmacopœia, and in the Pharmacopœias of India and the United States.

Medical Properties and Uses.—Its effects and uses are the same as those of the tops; and it is by far the most convenient and certain preparation of savin for internal administration.

Substitute.—In the Pharmacopœia of the United States, the tops of *Juniperus virginiana*, L., the Red Cedar, or American Savin, a common plant in the United States, are also official in the Secondary List of the Materia Medica. They have a powerful, bitterish, somewhat acrid taste; and a peculiar, not unpleasant odour. They have a strong resemblance to our savin tops, but are readily distinguished from them by their difference of odour.

Red Cedar tops owe their properties to a *volatile oil*, which is said to be sometimes substituted for the official oil of savin in the United States. They contain, however, a far less proportion of oil than true savin tops.

In their properties and uses they closely resemble the ordinary savin tops, and in the form of corresponding preparations they are sometimes employed as a substitute for them. They are, however, much less active.

Per. Mat. Med., vol. ii, pt. 1, p. 329; Per. Mat. Med., by B & R., p. 486; Pharmacographia, p. 567; U. S. Disp., by W. & B., pp. 508, 752, and 1312; Watts, Dict. Chem., vol. v, p. 201; Amer. Journ. of Pharm., vol. xiii, p. 15.

DESCRIPTION OF PLATE.

Drawn from a specimen collected by Pallas in the Altai, in the British Museum, the female flower (figs. 2 & 3) added from Berg & Sch.

1. A branch of a female tree with fruit.
2. Female cone, with 2 ovules.
3. Vertical section of the same.
4. The same somewhat further advanced.
5, 6. Fruit.
7. Vertical, and—8. Transverse section of a fruit.
9. A seed.
10. Vertical section of the same.
11. Portion of ultimate branchlet with leaves.

(2–5, 7–11 enlarged.)

D.Blair ad nat. del. et lith.

M&N.Hanhart imp.

JUNIPERUS COMMUNIS, *Linn.*

N. Ord. Coniferæ.
Tribe *Cupresseæ*.
Genus Juniperus, *Linn.*

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255. Juniperus communis, *Linn., Sp. Pl., ed.* 1, *p.* 1040 (1753).

Juniper.

Figures.—Woodville, t. 6; Bigelow, t. 44; Nees, t. 86; Steph. & Ch., t. 141; Berg & Sch., t. 8 e; Syme, E. B., viii, t. 1382 (bad); Nees, Gen. Fl. Germ., Apet.; Reich, Ic. Fl. Germ., xi, t. 535; Schnitzlein, Iconogr., t. 76.

Description.—A dwarf, procumbent, bushy evergreen shrub, or a neat bush 2—5 feet high with upright branches, or a small tree reaching 30 feet high; bark chocolate-brown, coming away in flakes on the old branches, young twigs divaricate. Leaves very numerous, persistent, arranged mostly in threes, spreading at right angles and rigid; when full-grown, about $\frac{1}{2}$ inch long, linear, tapering to a sharp prickly point, articulated on stem, with a prominent knob at the base above, channeled, glaucous or pinkish, with green margins, above, bluntly keeled and bright green beneath; shorter and more concave at the base of the branches. Flowers diœcious, the male in small catkins, the female in little cones; all axillary. Male catkins with a few small scales at base, ovoid or globose, about $\frac{1}{8}$ inch long, consisting of several whorls of decussate horizontal stamens, each with three or four anther-cells attached to the base of the lower surface of the connective, dehiscing vertically. Female cones about $\frac{1}{8}$ inch long, consisting of about 12—16 green, ovate, acute, fleshy scales, closely placed in 3 to 5 rows on a short axis and overlapping, the lower empty; the uppermost 3 surrounding the naked ovules, thinner, pinkish. Ovules erect, 3, alternating with the scales, in close contact and terminating the axis of the cone, flask-shaped, micropyles prolonged and projecting slightly beyond the uppermost scales. Fruit berry-

like (a galbulus) from the growth of the three uppermost bracts of the cone, which become greatly enlarged, fleshy, and completely coalescent except at their tips, and arching over the top enclose the seeds, at first green, and not ripening till the second year, when ripe purplish-black, soft, and covered with a whitish-blue "bloom," about the size of a pea, surrounded at the base with the empty scales of the cone. Seeds small, 3 in each fruit, close together, their upper half conical and triangular, the lower rounded; testa very hard, with several large glands or sacs on its lower part; embryo straight, in scanty endosperm, cotyledons 2, small; radicle superior.

Habitat.—The juniper, under one or other of its varieties (5 are described by Parlatore), has a very extensive distribution, extending throughout Europe and North Africa, Asia northwards from the Himalayas, Japan, and North America; the dwarf form reaches far into the arctic regions, occurring in Greenland and Kamtschatka. In England it grows in hilly places, and is a widely diffused though not very common species; in the south it especially prefers chalk downs, but also occurs on dry sandy heaths.

Some botanists consider the three uppermost scales of the cone as open carpels; it is worthy of remark that the ovules *alternate* with these and do not stand in their axils.

Parlatore, in DC. Prod., p. 479; Syme, E. B., viii, p. 273; Hook. f., Stud. Fl., p. 348; Wats., Comp. Cyb. Brit., p. 319; A. Gray, Man. Bot. U. S., p. 473; Hook., Fl. Bor. Am., ii, p. 165; Roxb., Fl. Ind., iii, p. 839; Brandis, For. Fl., p. 535; Lindl., Fl. Med., p. 556.

Official Part and Name.—Oleum Juniperi. The oil distilled in Britain from the unripe fruit (B. P.). The fruit (*Juniperi Fructus*) (I. P.). Juniperus. The fruit (U. S. P.).

1. The Fruit.—The fruit is commonly called a berry, although properly a *galbulus*. Juniper fruits are largely collected in Savoy, and also in the South of France, in Austria, and Italy. They are principally exported from Trieste and some Italian

ports. In this country, however, the oil, which is alone official, is directed to be distilled from the unripe fruit in Britain.

The juniper fruits of commerce are round, about the size of a pea or a black currant, of a deep purplish-black colour, and covered by a glaucous bloom. They are marked at the summit with three radiate furrows, and below with stellately arranged minute scales. Each fruit contains three bony seeds enveloped in a brownish-yellow pulp. The fruits have an agreeable aromatic odour when bruised; and a warm, somewhat spicy, sweetish, slightly terebinthinate taste.

Their properties are essentially due to a volatile oil (see *Oleum Juniperi*). They also contain a large quantity of *sugar*, some *resin*, and a very small proportion of an uncrystallisable substance named *juniperin*.

2. Oil of Juniper.—This is readily obtained by submitting the fruit to distillation with water. The volatile oil is most abundant in the full-grown green fruit, as in the course of ripening some of the oil becomes converted into resin. The amount of oil obtainable varies from 1 to 2 per cent. The oil is a colourless or pale greenish-yellow liquid, of a sweetish odour, and warm aromatic taste. It is limpid, transparent, levogyrate, and has a specific gravity varying from 0·839 to about 0·900. It is a mixture of two oils.

Juniper tops were formerly official, and possess similar properties to the fruit. Both the tops and juniper wood yield a volatile oil, which is frequently distilled abroad. It is sometimes substituted in this country and the United States of America for the official oil of juniper. It is sold at a much lower price than the true oil of juniper; and in its characters closely resembles oil of turpentine.

Medical Properties and Uses of Juniper Fruit and Oil.—Juniper fruit and oil possess carminative, stimulant, and diuretic properties; their action closely resembling terebinthinate substances. They communicate a violet odour to the urine of those taking them; and in large doses sometimes occasion irritation of the bladder and urinary passages. They have been found espe-

cially useful in different forms of dropsies, either administered alone, or in combination with other diuretics, more especially digitalis. They have been also employed in mucous discharges, as gonorrhœa, gleet, and leucorrhœa; and in some cutaneous diseases. Sir James Simpson considers oil of juniper an efficient diuretic when administered through the lungs, and he recommends for this purpose a teaspoonful of the oil to be put into a vessel of hot water, and the patient directed to inhale the vapours.

Formerly juniper fruits were "employed as a spice to food; and a spirit, of which wormwood was an ingredient, was obtained from them by fermentation and distillation. This spirit, called in French *Genièvre*, became known in English as *Geneva*, a name subsequently contracted into Gin." At the present time the gin distilled in Scotland is slightly flavoured with juniper berries, two pounds of berries being used to 100 gallons of gin; but the gin ordinarily distilled in England is flavoured with oil of turpentine.

The wood has been regarded as sudorific in its action, and according to Burnett, has been substituted for guaiacum and sassafras. We have never met with such a substitution, and except by accident, it is scarcely likely to occur.

Per. Mat. Med., vol. ii, pt. 1, p. 327; Per. Mat. Med., by B. & R., p. 483; Pharmacographia, p. 565; U. S. Disp., by W. & B., pp. 507 and 1308; Garr., Mat. Med., p. 368; Steph. & Church., Med. Bot., by Burnett, pl. 141, vol. iii.

DESCRIPTION OF PLATE.

Drawn from a plant collected at Mickleham, Surrey, in June, with the male flowers added from Berg and Schmidt. 1. A branch of a female bush, with flowers and fruit in various stages. 2. A female cone. 3. Vertical section of the same. 4, 5. Ripe fruit. 6. Vertical, and 7. Transverse section of same. 8. A seed. 9. Vertical section of same. 10. Male catkin. 11. Section of same. 12. A single stamen. (2, 3, 5—12 all enlarged.)

PINUS PINASTER, *Soland.*

D.Blair F.L.S. ad nat. del. et lith.

M&N.Hanhart imp.

N. Ord. Coniferæ.

Tribe *Pineæ*. Lindl., Veg. Kingd., p. 226 (*N. Ord.*).

Genus **Pinus**,* *Linn.* (includes *Abies*, *Larix*, &c.). There are over 100 species, natives of the northern hemisphere in the Old and New Worlds.

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256. Pinus Pinaster,† *Solander, in Ait. Hort. Kew.*, iii, p. 367 (1789).

Maritime Pine. Cluster Pine. Pinaster.

Syn.—P. maritima, *Poir.*

Figures.—Nees, tt. 76, 77; Lamb., Ill. Gen. Pinus, ed. 2, tt. 9, 10; Syme, E. Bot., viii, t. 1381; Reich., Ic. Fl. Germ., xi, t. 525.

Description.—A large tree, attaining sixty feet in height, with an irregular, rounded, dense head, trunk thick, bare below, with many stout, rather verticillate branches above, bark red-brown, thick, fissured yet rather smooth, flaking off in layers, scales beneath the leaf-fascicles persistent on the young branches, recurved. Leaves in twos, the fascicle surrounded at the base by a close sheath which is about ½ inch long, thin brownish ash-coloured and scarcely fimbriated, 4—8 inches long, linear, erect, rigid, sharply pointed, deeply channelled, convex beneath, serrulated on margins, bright green. Flowers very small, unisexual, monœcious, the female with membranous bracts at the base, the male without bracts, all closely arranged in small catkins. Male catkins numerous, crowded at the base of a young branch, stamens (flowers) closely placed, with very short filaments, anthers 2-celled, the scale-like connective prolonged beyond the cells to form a large, rounded, denticulate, erect crest. Females cones usually in whorls of 3—7, small, globose-ovoid, crimson, carpellary scales closely imbricated, thick, spreading, roundish, with two ovules on the upper surface at the base, structure as in *P. sylvestris*. Ripe cones sessile, in whorls of several,

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* *Pinus*, in Greek πεύκη, the classical name for *P. Pinea*, Linn., the Stone Pine.

† *Pinaster* was the name given by Pliny to the wild form of the Stone Pine.

recurved or spreading, 4—6 inches long, conical-ovoid, somewhat tapering at the apex, bright brown, polished, scales very numerous, their exposed ends (apophysis, escutcheon) much thickened, widely rhomboidal, ¾—1 inch wide, with a prominent transverse ridge, elevated in the centre into a large, straight, pyramidal, rigid, more or less sharp point. Seed about 1½ inch long, the terminal, oblong, truncate, membranous, brown or striped wing occupying ⅚ of the length, structure as in *P. sylvestris*.

Habitat.—This handsome Pine is a native of South-western Europe, in the neighbourhood of the sea coast in Spain and Portugal, Southern and Western France; it extends eastwards in the Mediterranean basin to Algeria, Corsica, Southern Italy, Sicily, and Greece. It is thought to have been formerly native also in Ireland. The tree has been very extensively spread by long-continued sowing on several barren tracts of loose sand in many parts of the world, and especially on the west coast of France, where it now forms large forests. In this country a large portion of the bare sandy district called the Poole basin, on the confines of Hants and Dorset, was at the beginning of this century planted with this Pine, and the tree has in consequence become semi-naturalised in that district. The flowers appear in spring, and the cones ripen in the autumn of the second year. It was cultivated in England in 1596.

Syme, E. Bot., viii, p. 270; Gren. & Godr., Fl. France, iii, p. 154; Parlatore, in DC. Prod., xvi, 2, p. 382; Loudon, Arbor. et Frut. Brit., p. 2213; Lindl., Fl. Med., p. 554.

Official Parts and Names.—1. Oleum Terebinthinæ; the oil distilled from the oleo-resin (turpentine) obtained from Pinus palustris, *Miller's Dict.*, Pinus Tæda, *Linn.*, and sometimes Pinus Pinaster, *Aiton:* 2. Resina; the residue of the distillation of the turpentines from various species of Pinus, *Linn.*, and Abies, *Lam.* (B. P.). 1. Oleum Terebinthinæ; the oil obtained by distillation of the oleo-resin of Pinus palustris, *Lam.*, Pinus Tæda, *Linn.*, and sometimes from Pinus Pinaster, *Aiton:* 2. Resina; the residue of the distillation of the turpentines from various species of Pinus, *Linn.*, and Abies, *Lam.* (I. P.). This plant is not mentioned by

name in the Pharmacopœia of the United States, and is therefore only included generally in that volume as an official source of Oil of Turpentine and other products under the words "other species of Pinus."

This species yields the commercial variety of oil of turpentine known as *Bordeaux Turpentine;* but the *General Characters, Varieties, Composition, Medical Properties, Uses,* and all other particulars in reference to "Oleum Terebinthinæ" and "Resina," are given by us under "Pinus australis," which is their principal botanical source.

This tree also yields *tar* and *pitch,* which substances are described under *Pinus sylvestris.*

Galipot.—This term is applied in France to the turpentine which concretes upon the trunk of this tree; it is also known under the name of *Barras,* and was formerly termed *Garipot.* It is not official in the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States; but it corresponds to the official *Thus Americanum* which is described under *Pinus australis.*

Extraction.—Galipot is obtained in the Landes Department of France when the collection of ordinary turpentine for the summer is completed. At that period the oleo-resinous juice (turpentine) still runs from the wounds made in the trunk of the tree for its extraction; but as the temperature is not then sufficiently high to cause it to run quickly down to the foot of the tree, or because the oil is present in it in less quantity, it dries on the trunk in whitish stalactitic tears. It is collected in winter. Mathieu describes *galipot* as the pure concrete turpentine, which is detached in pieces without being mixed with fragments of the bark, &c.; and reserves the name of *barras* for the solidified turpentine which cannot be obtained without scraping the trunk; the latter is, therefore, impure galipot, as it is mixed with fragments of bark, chips, and other extraneous substances. Guibourt distinguishes by the name of *galipot fondu* the concrete turpentine melted and strained so as to free it from impurities.

General Characters and Composition.—As found in commerce,

galipot is a concrete substance, granular in texture, yellowish-white in colour, of a strong terebinthinous odour, and with a bitter and aromatic taste. It is completely soluble in alcohol. It is composed, like other turpentines, of an *amorphous resin,* and an *essential oil,* but the latter is in very small quantity; in this respect being intermediate between common resin, which contains no oil, and Burgundy pitch, in which the oil exists to but a small amount, as we have described in treating of that substance under *Pinus Abies.* The granular appearance of galipot is due to the presence of minute crystals of abietic acid, as may be seen when it is examined under the microscope. Sometimes the galipot is soft from containing a larger quantity of oil; in which case it is distilled with water, and the volatile oil thus obtained is known as *huile de rase.*

Medical Properties and Uses.—Galipot has similar properties to *Thus Americanum,* and is employed like it in the preparation of certain plasters.

In Germany it is frequently used to mix with Burgundy pitch, as noticed in our description of that substance, in the preparation of *Brauerpech* or *brewers' pitch,* for coating beer casks.

Per. Mat. Med., vol. ii, pt. 1, p. 300; Pharmacographia, pp. 547 and 549; Guibourt, Hist. des Drog., vol. ii, p. 263; U. S. Disp., by W. & B., p. 865; Morel, in Pharm. Journ., vol. viii, ser. 3, pp. 81 and 344.

DESCRIPTION OF PLATE.

Drawn from a cultivated specimen in the British Museum; the female flowers added from Lambert.

1. A branch with male catkins.
2. A single male catkin.
3. An anther.
4. Female catkin.
5. A ripe cone.
6. Vertical section of the same.
7. A separate scale, with ripe seeds *in situ.*
8. A single seed.
9. Section of the same.

(2, 3, 9 enlarged.)

D.Blair ad.nat del.et lith.

M&N.Hanhart imp.

PINUS SYLVESTRIS, *Linn.*

N. Ord. Coniferæ.

Tribe *Pineæ*.

Genus Pinus, *Linn.*

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257. Pinus sylvestris, *Linn., Sp. Plant., ed.* 1, *p.* 1000 (1753).

Scotch Fir.

Figures.—Woodville, t. 1; Steph. & Ch., t. 73; Nees, t. 80; Berg and Sch., t. 8 d; Hayne, xiv, t. 9; Syme, E., Bot., viii, t. 1380; Reichenb., Ic. Fl. Germ., xi, t. 521; Lambert, Pinus, t. 1; Nees, Gen. Fl. Germ.; Richard, Comm. de Conif., t. 11.

Description.—A tall tree reaching under favorable conditions 70 or 80 feet in height, with a rounded or rather flat spreading somewhat dense head ; trunk rather slender, usually simple, rarely reaching 10 or 12 feet in circumference, branches numerous, irregular, spreading, tortuous, bark reddish-grey, deeply fissured, breaking off in flaky pieces. Leaves in twos, the fascicle surrounded at the base by a sheath of scales which become torn and fimbriated, evergreen, 2—3 inches long, linear-subulate, stiff, sharply pointed, minutely serrulate on the margin, channelled above, convex beneath, slightly glaucous, smooth. Male catkins small, about $\frac{1}{6}$ inch long, ovoid, shortly stalked, with a few papery, orange-coloured bracts at the base, crowded upon the lower part of a young branch which is terminated by a leaf-bud afterwards growing out into a shoot ; anthers numerous in each catkin, very shortly stalked, closely placed on the slender axis, 2-celled, cells placed on the lower surface of the connective which is slightly prolonged beyond them into a membranous tongue, dehiscing by wide longitudinal openings, pollen-grains bright yellow, globose with two protrusions, giving the appearance of being in threes. Female cones usually 2 or 3 together, each terminating a young shoot, and surrounded at the base by scales and whorls of young leaf-fascicles in their sheaths, roundish-ovoid, about $\frac{1}{4}$ inch long, at first erect; bracts membranous, roundish, deciduous, carpellary scales exceeding the bracts, fleshy, thick-

ened at the end, and provided at the top with a projecting point; ovules 2, inverse, bottle-shaped, placed obliquely on the base of the scale, the open mouths with longish teeth. Ripe cones shortly stalked, usually solitary, reflexed, ovoid-conical before opening, 1—1½ inches long, brownish ash-coloured, scales not numerous, woody, linear-oblong, imbricated, the ends much thickened, their exposed part (apophysis) oblique, rhomboidal, with a transverse ridge and central tubercle, the lower ones shorter and empty, the upper ultimately widely separating and spreading. Seeds over half an inch long, the membranous wing occupying over ¾ of the length, testa woody, embryo polycotyledonous in the axis of somewhat fleshy endosperm.

Habitat.—The Scotch Fir forms vast woods in many parts of Northern Europe and Asia, extending into the arctic regions; it is also a native of the Central European chains, reaching up to 6000 feet in the Alps and Pyrenees, and its range extends into the Caucasus, Armenia, and Cappadocia. In Britain there is no doubt it was at one time common, but it is now only met with in the native state in a few of the Highland forests of Scotland; it is, however, extensively planted in heathy and sandy districts, and has become semi-naturalised in such localities.

The cone takes two years to ripen, and undergoes considerable changes in form and colour during that period.

Hook. f., Stud. Fl., p. 348; Syme, E., Bot., viii, p. 264; Watson, Comp. Cyb. Br., p. 319; Parlatore, in DC. Prod., xvi, 2, p. 560; Lindl., Fl. Med., p. 553.

Official Parts and Names.—Pix Liquida, *Tar;* a bituminous fluid obtained from the wood of Pinus sylvestris, *Linn.* and other pines by destructive distillation (B. P.). A bituminous liquid (*Liquid or Wood Tar*), obtained by destructive distillation (I. P.). Pix Liquida; the impure turpentine from the wood of Pinus palustris, and of other species of Pinus, procured by burning (U. S. P.).

Preparation and Commerce.—The official pine-wood tar is procured by the destructive distillation of fir timber in the northern parts of Europe, and in America, and is known in commerce as *Archangel tar, Stockholm tar,* and *American tar.* The great bulk of that used in Europe and known as Archangel or Stockholm tar, is prepared in Finland, Sweden, and Northern and Central Russia, and is procured to a large extent from Pinus sylvestris, *Linn.;* that used in America is said to be chiefly obtained from Pinus palustris, *Mill.* (Pinus australis, *Mich.*). The tar obtained in Europe is generally considered to be superior to American tar.

The process now usually followed for obtaining tar is essentially the same as that practised by the Macedonians, and described by Theophrastus. It is a kind of downward distillation of the roots and lower portions of the trunks of the old pines; the more valuable parts of the trees being used as timber. The process as carried on in Bothnia has been thus described by Dr. Clarke:—The situation most favourable to the process is in a forest near to a marsh or bog, because the roots of the fir, from which tar is principally extracted, are always most productive in such places. A conical cavity is first made in the ground (generally in the side of a bank or sloping hill); and the roots of the fir, together with logs and billets of the same, being neatly trussed in a stack of the same conical shape, are let into this cavity. To prevent the volatile parts from being dissipated, the whole is then covered by turf, which, by means of a heavy wooden mallet and wooden stamper, worked separately by two men, is beaten down, and rendered as firm as possible about the wood. The stack of billets is then kindled, and a slow combustion of the fir takes place, without flame, as in making charcoal. During this combustion the tar exudes, and a cast-iron pan being at the bottom of the funnel, with a spout which projects through the side of the bank, barrels are placed beneath this spout to collect the fluid as it comes away. As fast as the barrels are filled, they are bunged and ready for immediate exportation. The time required for this slow combustion varies according

to circumstances (more especially from the size of the stacks), from one to four weeks; and the amount of tar thus obtained by this rude process is from 7 to 8 per cent. An improved and more rapid method for obtaining tar by distillation in properly constructed stills, has recently been introduced into Russia, by which more than twice this amount of tar can be obtained.

The amount of tar imported into Great Britain in 1872 was 189,291 barrels, of which 145,483 barrels were shipped from Russian ports. A barrel usually contains about 30 gallons.

General Characters and Composition.—Tar is a viscid, semi-liquid, brownish-black substance, with a peculiar aromatic odour. Its viscidity is, however, destroyed by heat. When examined by a magnifying lens, colourless crystals of *Pyrocatechin* may be commonly observed in tar, although in some varieties they cannot be detected. Tar is soluble in alcohol, ether, or chloroform, and in the fixed and volatile oils. Water agitated with it acquires a pale brown colour, sharp empyreumatic taste, and acid reaction. This acid reaction is due to the presence of pyroligneous acid. The vapour of tar is highly inflammable.

Tar is a very complex substance; but consists principally of *empyreumatic resin, acetic acid,* various *liquid hydrocarbons, resin,* and *oil of turpentine.*

Medical Properties and Uses.—Tar acts both locally, and internally, as a stimulant. It is also regarded as diuretic, and diaphoretic. Externally in the form of tar ointment or tar water, it has a well-established reputation in some chronic skin diseases, as eczema, psoriasis, lepra, ringworm, and others. Tar ointment has also been found a useful application to foul and indolent ulcers. Tar has likewise been employed successfully as an internal remedy in chronic bronchitis, typhoid fever, and habitual constipation. The vapour from heated tar has been also advantageously used in phthisis, chronic bronchitis, and other pulmonary affections. Tar is also much employed in veterinary practice, in the treatment of thrush in the horse; foot-rot in sheep; and various skin affections, &c.

But a very small quantity of tar is, however, used in medicine.

Its chief consumption is in ship-building, and for the preservation of fences, &c.

Other Products of Pinus sylvestris.—Besides the official tar as above described, several other substances are also obtained from this tree. Thus oil of turpentine is an important product; this is described under *Pinus australis* and *Pinus Tæda*.

Pitch, Black Pitch, or *Pix arida,* which was formerly official in our pharmacopœias, is another valuable product. It is obtained by submitting tar to distillation, when the residuum left in the still is pitch. At ordinary temperatures, pitch is an opaque, black, solid substance, breaking with a shining conchoidal fracture. It softens by the heat of the hand, and is readily soluble in alcohol and the other liquids already mentioned as solvents of tar. It has very little taste, but a disagreeable odour. Pitch consists of resin, combined with various other empyreumatic resinous substances which are commonly known under the name of *pyretin.* Pitch is very largely imported into this country from Russia, and also to some extent from other tar-producing countries; it is also manufactured here from tar. The chief consumption of pitch is for similar purposes as tar, but it is also occasionally used like it in medicine. Thus externally in the form of an ointment, as an application to obstinate skin diseases, and to foul and indolent ulcers; but tar is generally preferred in such cases. It has likewise been recommended as an internal remedy in skin diseases and in piles. It is also used in veterinary practice, more especially as a mild stimulant application in thrush and canker in horses; and foot-rot in sheep.

Pinus sylvestris also yields the valuable timber known as Dantzic or Riga Fir, and Russian Deal. The inner bark is likewise used in Norway for making Bark Bread. From the leaves of this species of Pinus the substance called Pine-wool or Fir-wool is also chiefly prepared. This wool is used for stuffing mattresses, &c., and is said to be repulsive to vermin. Wadding for medical use, and cloth for numerous articles of dress, &c., are also manufactured from these leaves. An oily substance called fir-wool oil or fir-wool spirit has also been introduced into this country from

Germany, and recommended for external use in rheumatism, neuralgia, &c. Paper of good quality is now also manufactured from the wood of this and some other species of *Pinus* and *Abies*.

Per. Mat. Med., vol. ii, pt. 1, p. 321; Pharmacographia, pp. 560 and 564; Steph. & Church., Med. Bot., by Burnett, vol. ii, pl. 73; U. S. Disp., by W. & B., p. 679; Garr., Mat. Med., p. 368; Tuson's Veterinary Pharmacopœia, p. 199; Bentl., Man. Bot., p. 645; Watts, Dict. Chem., vol. v, p. 669.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Royal Gardens, Kew.

1. A branch with male and female flowers, and an immature and ripe fruit.
2. A female cone.
3. Vertical section of the same.
4. Under, and—5. Upper surface of a carpellary scale.
6. A male catkin.
7. A stamen seen from below and from the side.
8. A scale of ripe fruit showing the two seeds *in situ*.
9. Lower surface of the same.
10. Section of seed.

(2–7 and 10 enlarged.)

D.Blair F.L.S. ad sicc. del. et lith.

PINUS AUSTRALIS, *Mich.*

M & N. Hanhart imp.

N. Ord. Coniferæ.

Tribe *Pineæ*.

Genus Pinus, *Linn.*

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258. Pinus australis, *Michaux, Arbres Forest. de l'Amer. i, p.* 62 (1810).

Broom Pine, Pitch Pine, Yellow Pine, Long-leaved Pine.

Syn.—P. palustris, *Mill.*

Figures.—Lamb., Ill. Gen. Pinus, ed. 2, t. 20; Mich. f., N. American Sylva, iii, t. 141.

Description.—A tree of 60—70 feet in height, with an erect straight thick trunk, and a wide head of horizontally spreading whorled branches, bark somewhat furrowed and detaching itself in thin sheets, buds very large, white, fringed; scales beneath the leaf fascicles very long. Leaves numerous, in threes, each cluster surrounded with a tough, yellowish, wrinkled laciniated sheath an inch long, closely arranged at the extremities of the branches, about a foot long, spreading or pendulous, very narrow, compressed-triquetrous, sharp at the point, finely scabrous on the margin, bright green. Male catkins rather long, many, cylindrical, spreading, about two inches long, violet, pollen yellow; anthers with a large rounded crest. Ripe cone pendulous, large, 7 or 8 inches long, oblong, slightly conical and tapering to a blunt point, cylindrical, straight or somewhat curved, pale brown, carpellary scales much thickened and woody, with the exposed part rhomboidal, elevated in the centre, with a prominent transverse keel, and a short sharp incurved central spine. Seeds white, with a very large wing.

Habitat.—The oldest name for this species has been generally discarded for that here employed, as it was thought to be inapplicable, the tree never growing in marshes. The Pitch Pine forms almost the whole growth of the extensive dry and sandy wastes called the "Pine barrens," which, commencing at Norfolk,

Virginia, extend southward for 600 miles through Carolina, Georgia, and Florida, with a width from the coast of 100 miles. There it forms vast woods and attains a great size, and a peculiar habit. It flowers in April (when the vast quantities of pollen produced covers the surface of the country with a yellow dust), and the large cones are ripe in October. From the Northern States it is quite absent.

P. australis is almost too delicate a species for this country, where, however, it is occasionally grown, but does not produce fruit. It was introduced in 1730.

Chapman, Fl. South. States, p. 434; Parlatore, in DC. Prod., xvi, pt. 2, p. 392.

Official Parts and Names.—1. THUS AMERICANUM; the concrete turpentine of Pinus Tæda, *Linn.*, and Pinus palustris, *Miller's Dict.*: 2. OLEUM TEREBINTHINÆ; the oil distilled from the oleo-resin (turpentine) obtained from Pinus palustris, *Miller's Dict.*, Pinus Tæda, *Linn.*, and sometimes Pinus Pinaster, *Aiton*: 3. RESINA; the residue of the distillation of the turpentines from various species of Pinus, *Linn.*, and Abies, *Lam.* (B. P.). 1. The concrete turpentine of Pinus palustris, *Lambert*, and Pinus Tæda, *Linn.*: 2. The oil obtained by distillation of the oleo-resin (turpentine) of Pinus palustris, *Lambert*, Pinus Tæda, *Linn.*, and sometimes Pinus Pinaster, *Aiton*: 3. RESINA; the residue of the distillation of the turpentines from various species of Pinus, *Linn.*, and Abies, *Lamb.* (I. P.). 1. TEREBINTHINA; the concrete oleo-resin obtained from Pinus palustris, and from other species of Pinus: 2. OLEUM TEREBINTHINÆ; the volatile oil distilled from the turpentine of Pinus palustris, and of other species of Pinus: 3. RESINA; the residue after the distillation of the volatile oil, from the turpentine of Pinus palustris, and of other species of Pinus.

Nature of Turpentine.—The name of turpentine is applied to the liquid or soft solid oleo-resinous juice of several coniferous plants, as *Pinus australis* (*palustris*), *P. Tæda*, *P. Pinaster*, *P. sylvestris*, *Pinus* (*Abies*) *balsamea*, *Pinus* (*Abies*) *Picea*, *Pinus Larix*, and some others; as also to the similar juice of the *Pistacia Terebinthus*, a

plant of the order Anacardiaceæ. A description of the different turpentines obtained from these plants may be found in this work, under their proper names. By distillation these oleo-resins are resolved into *volatile oil* and *resin*. At first they are fluid, but by age and exposure to the air they become, more or less speedily, solid; a change which is partly due to the volatilisation, and partly to the resinification, of their volatile oil.

Varieties and Commerce.—As noticed under *Pinus Tæda*, there are three varieties of the crude oleo-resin or common turpentine known in commerce, namely, American Turpentine, Bordeaux Turpentine, and Russian Turpentine; the first being chiefly obtained from *Pinus australis*, but, to some extent, also, from *P. Tæda;* the second from *P. Pinaster;* and the latter from *P. sylvestris*. The two former kinds are those alone which are specially referred to in the British, Indian, and United States Pharmacopœias, and of these, by far the larger proportion used in Great Britaiu is the American kind. But the Russian variety is also now coming into considerable use in this country.

American turpentine reaches Europe from the United States, chiefly by way of Boston, hence it is known in France, as "Boston Turpentine." It is principally extracted in Virginia and the Carolinas. Bordeaux Turpentine, which is collected in the Landes Department, and in the neighbourhood of Bordeaux, in France, is imported chiefly from Bordeaux. Russian Turpentine is obtained in Russia and Finland, and is usually imported into Great Britain from Russia.

Extraction and General Characters.—The method of obtaining turpentine in a crude state varies somewhat in different countries. The mode by which American Turpentine is extracted in North Carolina is fully given by Flückiger and Hanbury in Pharmacographia, and the following is an extract of the process. In the winter months the negroes in a *Turpentine Orchard*, as the district of the forest to be worked is called, are occupied in making cavities in the trunks of the trees, which are commonly known as boxes. These boxes are made from 6 to 12 inches above the ground, and each so constructed as to hold about a quart. From one to four

boxes are made in each tree, a few inches of bark being left between them. The greater number of trees from which the turpentine is obtained are from 12 to 18 inches in diameter, and have three boxes each. The boxes having been made, the bark and a little of the wood immediately beneath it, which are above the box, are *hacked;* and from this excoriation the sap begins to flow about the middle of March, gradually filling the box. Each tree requires to be freshly hacked every eight or ten days, a very slight wound above the last being all that is needed. The hacking is carried on year after year, until it reaches 12 to 15 feet or more up the tree. The turpentine, which is called *dip,* is removed from the boxes by a spoon or ladle of peculiar form, and placed in barrels. The first year's flow of a new tree, having but a small surface to travel before it reaches the box, is of special goodness and is termed *Virgin dip* or *Virgin turpentine.* An orchard will ordinarily remain productive for fifty years. Some of the turpentine thus extracted is exported; but the larger proportion is distilled in the neighbourhood of the turpentine orchards.

When thus imported American turpentine is a yellowish-white, viscid, honey-like fluid, which is at first somewhat opaque, but it becomes transparent by exposure to the air; it has an aromatic, agreeable odour; and a warm, bitterish taste. In cold weather it thickens, and its consistence is then that of a soft solid. After long keeping in a bottle it may be seen to have separated into two layers: the lower being more or less opaque or turbid, from the presence of crystals of abietic acid, which are readily observable under the microscope; and the upper layer clear and slightly fluorescent. American turpentine usually contains various impurities, as leaves, twigs, chips, &c., hence it is melted and strained, and in this state it is sometimes termed refined turpentine.

Bordeaux or French turpentine is also obtained by incising the trees, but instead of making deep cavities in them in order to collect the oleo-resin, a suitable vessel is placed for that purpose below the lowest incision. It agrees essentially in its characters with American turpentine, but it has a less agreeable odour and taste.

Russian turpentine is remarkable for its fragrant odour.

Tilden says "that there is no doubt, from the presence of empyreumatic products in it, that it is not procured by exudation from the living trees, but obtained in the distillation of tar from the wood of various Coniferæ."

These oleo-resins are, as their name implies, mixtures of resin and volatile oil, the latter varying in proportion in different specimens, from about 15 to 30 per cent. Bordeaux turpentine yields more volatile oil than the American variety. Their two constituents will be presently described under the heads of "Oleum Terebinthinæ," and "Resina."

1. Thus Americanum, or Terebinthina.—This, as we have seen, is the concrete oleo-resin or turpentine of *Pinus Tæda* and *Pinus palustris;* the analogous product from *Pinus Pinaster* is termed Galipot, and is fully treated of by us in our description of that plant. Under *Pinus Abies,* we have also specially distinguished the original *Thus,* which was obtained from this plant, from the present official *Thus Americanum;* which derives its distinctive name from being imported from the Southern States of North America.

Nature and General Characters.—This oleo-resin, which is usually known as *Common Frankincense* or *Gum Thus,* is the turpentine which concretes spontaneously upon the surface of the pines during the collection of ordinary American turpentine. It is scraped off the trees, and put into separate barrels, and hence is distinguished in the market as *scrape.* But very little is, however, collected. Like other turpentines it is composed of an *amorphous resin* and a *volatile oil,* but the latter is generally in very small quantity.

When fresh it is a softish, bright yellow, opaque, tough, solid, with the same odour as crude American turpentine; but by keeping it becomes dry and brittle, and of darker colour, and milder odour. As imported it is more or less contaminated with pine leaves, chips of wood, and other impurities; from which it should be separated before it is used by straining. When examined under the microscope it is seen to consist chiefly of minute crystals of abietic acid.

Medical Properties and Uses.—It is only used externally as a stimulant application, when mixed with other ingredients, in the form of a plaster. In the British Pharmacopœia it is an ingredient of Pitch plaster, where, besides its stimulant action, it serves to improve the consistence and colour. It was formerly employed in this country instead of olibanum in the preparation of incense.

2. Oleum Terebinthinæ.—Oil of Turpentine is also commonly called *spirits* or *spirit of turpentine* and *essence of turpentine.*

Preparation.—Oil of turpentine may be distilled from the oleo-resin either with or without water; but in the latter case a much higher temperature is required, and the product is liable to be empyreumatic. It may be procured quite pure if redistilled from a solution of potash. In this country oil of turpentine is usually obtained by distilling a mixture of American turpentine, which has been melted and strained, and water; but a large quantity is also imported from North Carolina, where it is distilled in copper vessels without water. The oil derived in a similar way from Bordeaux turpentine has a more disagreeable odour, and the residue (resin) which is left in the still is of inferior quality to that obtained from American turpentine.

General Characters and Composition.—Oil of turpentine when pure, is a limpid, colourless, very inflammable liquid; with a strong peculiar odour, which varies in the different varieties; and a pungent, bitterish taste. Its specific gravity also varies from 0·856 to 0·870, and its boiling point ranges from about 305° to 341° in the different kinds. It likewise exhibits differences in its optical properties; thus American oil of turpentine is dextrogyre, and Bordeaux turpentine levogyre. It is almost insoluble in water; soluble in about seven parts of rectified spirit, and readily soluble in absolute alcohol, ether, and benzol. It is an excellent solvent for caoutchouc, sulphur, and phosphorus; and it also dissolves the volatile and fixed oils, and resins, forming with the latter varnishes. Oil of turpentine essentially consists of a mixture of various hydrocarbons, all of which have the formula $C^{10}H^{16}$; and in some cases the action of metallic sodium indicates

the presence also of some oxygenated oils, although none of these have been isolated.

Medical Properties and Uses.—In small doses oil of turpentine becomes absorbed, and acts as a general stimulant, antispasmodic, and astringent; its action being principally directed to mucous surfaces, more especially influencing the genito-urinary organs, and thus increasing the quantity of urine, to which it communicates an odour resembling that of violets. Its action resembles that of copaiba on the genito-urinary organs. In large doses it acts as a purgative and anthelmintic; under which circumstances when not removed by the bowels it sometimes causes strangury and a kind of intoxication. Locally applied it is a valuable rubefacient and counter-irritant.

As a general stimulant oil of turpentine has been found useful in low forms of fever, as in cases of typhus and typhoid, and in other circumstances where the vital powers are much depressed. As an astringent it is frequently of service in passive forms of uterine and intestinal hæmorrhage. As an antispasmodic it is frequently a valuable remedy in hysterical affections, when it is usually administered as an enema. As a diuretic it is occasionally prescribed in chronic forms of dropsy; but its use is contra-indicated in dropsies attended with irritation of the urinary organs. As a purgative it has been highly extolled as a remedy in tympanitis and obstinate constipation, when it may be given by the mouth, or employed in the form of an enema. It has also been used with varying success in dysentery, purpura, some forms of iritis, chronic rheumatism in old and debilitated persons, sciatica and other neuralgic affections, and in other diseases. But as a remedy it is probably most valuable as an anthelmintic, in cases where tænia, ascarides, or other entozoa are present in the intestines; indeed, as a remedy for tapeworm, it is regarded by many practitioners as the most effectual remedy we possess.

Externally, in the form of the official liniments or ointments, or as a stupe or fomentation, it is frequently a most serviceable application in chronic rheumatism, sprains, and neuralgic and

other chronic painful affections ; also to indolent and ill-conditioned ulcers, in tympanitic conditions of the abdomen resulting from peritoneal inflammation, and as a local stimulant in cases of burns and scalds.

Oil of Turpentine is also very extensively used in the arts in the preparation of varnishes, and for many other purposes ; as also are various preparations from it ; but the consideration of these is not within our province. A purified oil of turpentine has also been much used under the name of Camphene, for illuminating purposes ; but it is now scarcely ever employed in this way.

3. Resina.—*Preparation and Varieties.*—Resin is the residue left after the distillation of the oil of turpentine from the crude oleo-resin (turpentine). It is also termed *rosin* and *colophony*. While liquid the resin is received into metallic receivers coated with whiting to prevent adhesion, and from these it is ladled into moulds or casks. In this state it contains a little water, and constitutes the official resin of the British, Indian, and United States Pharmacopœias ; this resin is also termed *yellow resin*. When freed from water by fusion, the resin becomes transparent and is then known as *transparent resin* ; or if exposed long to heat it acquires a deeper colour, and forms *black resin ;* or if, when in a state of fusion, it is strongly agitated with water, it becomes of a whitish colour and opaque, and is then termed *white resin*. Crude turpentine contains from about 70 to 85 per cent of resin.

General Characters and Composition.—The official resin is a translucent, yellowish, compact, solid substance ; which is brittle and pulverisable, and breaks with a shining fracture ; its odour and taste are faintly terbinthinate ; and it is readily fusible, and burns with a dense yellow flame and much smoke. When boiled with the caustic alkalies it forms soaps which are soluble in water, and are commonly known as *resin-soaps*.

Resin is essentially composed of the *anhydride of abietic acid ;* thus, from 80 to 90 per cent. of this acid in a crystalline state has been obtained from it. Various other acids have also been indicated by different chemists as constituents ; for instance, *sylvic*,

pimaric, and *pinic*, but their origin and nature require further investigation.

Medical Properties and Uses.—The principal value of resin in pharmacy is in the preparation of plasters and ointments, to which it communicates great adhesiveness, and slightly stimulant properties. Hence these are used as stimulant applications to indolent and ill-conditioned ulcers, especially those arising from burns and scalds; to blistered surfaces to keep up a discharge; and also as a support to injured parts in surgery. Resin is not employed as an internal remedy. It is also said by Olmsted to act as a preservative agent to ointments by preventing the oxidation of their constituent fatty substances.

Besides its employment in medicine, it is far more important for its economical uses, as in the preparation of soaps, sealing-wax, varnishes, cements, &c.

Other Uses of Pinus australis.—Besides the official substances obtained from this tree, the timber known to builders as Georgia Pitch Pine is derived from it, as well as tar, pitch, and other valuable products.

Per. Mat. Med., vol. ii, pt. 1, pp. 302 & 308; Per. Mat. Med., by B. & R., p. 468; Pharmacographia, p. 546; U. S. Disp., by W. & B., pp. 726 & 864; Guibourt, Hist. des Drog., vol. ii (1869), p. 259; Watts, Dict. Chem., vol. v, p. 920; Amer. Journ. Pharm., vol. xxii, p. 325; Morel, in Pharm. Journ., ser. 3, vol. viii, pp. 81, 543, 725, & 982: Tilden, in Pharm. Journ., ser. 3, vol. viii, p. 447; Postans, in Pharm. Journ., vol. viii, ser. 3, p. 448.

DESCRIPTION OF PLATE.

Drawn from a cultivated specimen in the British Museum.

1. Extremity of a branch with male catkins.
2. A cone.
3. A cone-scale.

D. Blair F.L.S. ad sicc. del. et lith.

PINUS TÆDA, *Linn.*

M & N. Hanhart imp.

N. Ord. Coniferæ.

Tribe *Pineæ*.

Genus Pinus, *Linn.*

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259. Pinus Tæda,* *Linn., Sp. Plant., ed.* 1, *p.* 1000 (1753).

Loblolly. Oldfield Pine. Frankincense Pine.

Figures.—Lambert, Ill. Genus Pinus, ed. 2, tt. 17, 18; Michaux, N. American Sylva, iii, t. 143.

Description.—A large tree, 50 to 100 feet in height, with a wide spreading summit; bark very thick and much furrowed, the younger branches with lanceolate-acuminate scales beneath the leaf-fasicles, with recurved points and fimbriate margins. Leaves arranged in threes, each fascicle surrounded at the base by a close thin sheath about ½ inch long and torn at the top, rigid, erect, linear, acute, 6—10 inches long, bright green, smooth. Male catkins numerous, crowded, forming a dense mass, erect or curved, cylindrical, about an inch long; connective with a large tongue. Cones about 3 inches long, sessile, arranged 2—5 in a whorl, and spreading or deflexed, ovate-oblong, blunt, pale brown; scales numerous, woody, the apophysis narrowly depressed, rhomboidal, with an acute transverse ridge, elevated in the centre into a strong, wide, short, sharp, spreading, straight or curved spine. Wing of the seed three or four times its length.

Habitat.—This fine Pine is found in the Southern United States. It is abundant in the swamps which intersect the "pine-barrens" of Virginia and is very common near Charleston, but does not occur north of Delaware, nor far from the coast.

It is in cultivation in this country, but is not a very frequent species under such conditions.

A. Gray, Man. Bot. N. U. States, p. 469; Chapman, Fl. South. States, p. 433; Parlatore, in DC. Prod., xvi, pt. 2, p. 393; Michaux, N. Am. Sylva, iii, p. 156.

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* *Tæda* or *Teda*, the classical Latin name for some resiniferous tree.

Official Parts and Names.—1. THUS AMERICANUM; the concrete turpentine of Pinus Tæda, *Linn.*, and Pinus palustris, *Miller's Dict.:* 2. OLEUM TEREBINTHINÆ; the oil distilled from the oleo-resin (turpentine) obtained from Pinus palustris, *Miller's Dict.*, Pinus Tæda, *Linn.*, and sometimes Pinus Pinaster, *Aiton:* 3. RESINA; the residue of the distillation of the turpentines from various species of Pinus, *Linn.*, and Abies, *Lam.*, (B. P.). 1. The concrete turpentine: 2. The oil obtained by distillation of the oleo-resin of Pinus palustris, *Lam.*, Pinus Tæda, *Linn.*, and sometimes from Pinus Pinaster, *Aiton:* 3. RESINA; the residue of the distillation of the turpentines from various species of Pinus, *Linn.*, and Abies, *Lam.* (I. P.). 1. TEREBINTHINA; the concrete oleo-resin obtained from Pinus palustris, and from other species of Pinus: 2. OLEUM TEREBINTHINÆ; the volatile oil distilled from the turpentine of Pinus palustris, and of other species of Pinus: 3. RESINA; the residue, after the distillation of the volatile oil, from the turpentine of Pinus palustris, and of other species of Pinus (U. S. P.).

Varieties.—There are two principal varieties of the crude oleo-resin or common turpentine known in commerce, namely, *American Turpentine* and *Bordeaux Turpentine;* a third variety is also now coming into use, namely *Russian Turpentine.* The botanical source of the first is *Pinus australis,* Michaux (*P. palustris,* Mill.), and *P. Tæda,* L.; that of Bordeaux is from *P. Pinaster;* and that of Russian from *P. sylvestris,* L. By far the larger proportion used in this country is the American kind, and is principally procured from *P. australis.*

The *General Characters, Composition, Properties, Uses,* and all other particulars in reference to "Thus Americanum," "Oleum Terebinthinæ," and "Resina," are given under "Pinus australis."

Per. Mat. Med., vol. ii, pt. 1, p. 302; Per. Mat. Med., by B. & R., p. 468; Pharmacographia, p. 545; U. S. Disp., by W. & B., p. 864; Julius Morel, in Pharm. Journ., ser. 3, vol. viii, pp. 81, 344, 543 & 725; Tilden, in Pharm. Journ., vol. viii, ser. 3, p. 447; Postans, in Pharm. Journ., ser. 3, vol. viii, p. 448.

DESCRIPTION OF PLATE.

Drawn from a cultivated specimen in the British Museum.

1. A branch with male catkins.
2. A catkin.
3. An anther.
4. Ripe cones.

(3 enlarged.)

D.Blair, ad nat. del. et lith.

M&N.Hanhart imp.

PINUS LARIX, *Linn,*

N. Ord. Coniferæ.

Tribe *Pineæ*.

Genus Pinus, *Linn.*

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260. Pinus Larix,* *Linn., Sp. Plant. ed.* 1, *p.* 1001 (1753).

Larch.

Syn.—Abies Larix, *Lam.* Larix europæa, *DC.* L. decidua, *Miller.*

Figures.—Woodville, t. 4; Nees, t. 84; Berg & Sch., t. 11 b; Reichenb., Ic. Fl. Germ., xi, t. 531; Nees, Gen. Fl. Germ.; Lambert, Ill. Gen. Pinus, ed. 3, t. 48.

Description.—A tall tree, reaching 80 feet or more in height, with a straight trunk and spreading whorled branches, the smaller branchlets slender and elegantly pendent; bark flaky, whitish- or pinkish-grey, rosy-red beneath. Leaves deciduous, appearing in spring in spreading brush-like tufts, each containing numerous (30—40) leaves, from perennial permanent rounded buds projecting horizontally from the slender branchlets with a cup-shaped mouth; when full grown about an inch long, linear, rather blunt, entire, smooth, bright green. Fls. monœcious. Male catkins sessile, ovoid, reaching $\frac{1}{2}$ inch long, surrounded at the base by a cup formed of persistent adnate bracts, and by some inner deciduous, reflexed, fringed, brown scales; stamens numerous, crowded, anthers almost sessile on the thick central column, with a short recurved crest at the summit, 2-celled, opening longitudinally, pollen globose, pale yellow. Female cones shortly stalked, $\frac{3}{4}$ inch long, erect, ovoid, surrounded at the base with spreading linear leaves; bracts membranaceous, oblong or oval, blunt with a sharp central point, bright dark pink, the midrib and point green; carpellary scales not $\frac{1}{3}$ the length of the bracts, and adnate to their base, rounded; ovules 2, inverse, bottle-shaped, with a large papillose mouth. Ripe cones erect, light, 1 or $1\frac{1}{4}$ inch long, broadly ovoid, pale greyish-brown, axis solid and woody, carpellary scales hard,

* *Larix*, Pliny, from λάρικα, the name of the resin in the time of Dioscorides.

turpentines. It is not now used in this country, except in veterinary practice.

The substance called *Briançon Manna,* or *Manna of the Larch,* also exudes in the height of the summer from the leaves of the larch tree. It is a white saccharine substance, occurring in small, opaque, sometimes crystalline, usually oblong tears, enclosing the needle-like leaves; and without any very marked odour, but having a sweet taste. It contains a peculiar sugar called *Melezitose.* It was formerly used in medicine, but has now disappeared from commerce.

Per. Mat. Med., by B. & R., p. 1070; Pharmacographia, pp. 373, 549, and 551; U. S. Disp., by W. & B., p. 863; Stenhouse, in Phil. Trans., vol. clii (1862), p. 53; Mohl, in Botanische Zeitung (1859), p. 329; Greenhow, in Medical Times, Feb. 20, 1864; Dublin Hosp. Gaz., April 15, 1858, and Jan. 15, 1859; Amer. Journ. Pharm., Jan., 1859, p. 61, and Nov., 1862, p. 555; Guibourt, in Journ. de Pharm., vol. xxv, p. 500.

DESCRIPTION OF PLATE.

Drawn from a tree in Kew Gardens in April.

1. A branch, with cones and male and female flowers.
2. A male catkin.
3. Section of the same.
4. A stamen.
5. Section of female cone.
6. A bract, with the carpellary scale and ovules.
7. Upper view of ripe scale with the two seeds.
8. Outer view of same.
9. A seed.
10. Section of the same.

(2–10 enlarged.)

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N. Ord. Coniferæ.
Tribe *Pineæ*.
Genus Pinus, *Linn.*

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261. Pinus Picea,* *Du Roi, Observ. Botan., p.* 37 (1771).

Spruce Fir. Norway Spruce.

Syn.—P. Abies, *Linn. & Auct. plur.* P. excelsa, *Lam.* Picea vulgaris, *Link.* Abies Picea, *Mill.* A. excelsa, *DC.*

Figures.—Woodville, t. 2; Nees, t. 81 (bad); Lambert, Ill. Gen. Pinus, ed. 2, t. 27, cop. in Steph. & Ch., t. 75; Berg. & Sch., t. 11 c.; Reich., Ic. Fl. Germ., xi, t. 532; Nees, Gen. Fl. Germ.; Michaux, N. Amer. Sylva., iii, t. 146.

Description.—A large tree, attaining a height of 150 feet in favorable situations, with an erect, tapering, central stem, and numerous horizontal, somewhat drooping branches from base to summit, forming a pyramidal tapering head, bark rough, reddish, scaling off in flakes. Leaves numerous, solitary, closely placed and overlapping, usually curved upwards, but not spreading, in two ranks, $\frac{1}{2}$—$\frac{3}{4}$ inch long, readily disarticulating at the base which is not dilated, and leaving behind rigid, persistent, hard, truncate, projecting scars, stiff, linear, bluntly pointed, obscurely tetragonous, smooth, dark green. Male catkins numerous, shortly stalked, near the ends of the branches, with empty bracts at the base; anthers crowned with a triangular or truncate, dentate, scarlet crest, 2-celled, dehiscing longitudinally. Female cones solitary, terminal, erect, nearly sessile, broadly oblong, crimson; bracts small, lanceolate, with a serrate or denticulate margin; carpellary scales more than twice as long as the bracts, ovate, obtuse, or emarginate, denticulate, spreading. Ripe cone pendulous or drooping, 4—6 inches long, ovoid-oblong, cylindrical, blunt at both ends, purplish brown, scales numerous, very much exceeding the small bracts which scarcely increase in size, very persistent, tough and woody, densely imbricated, roundish-obovate or rhom-

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* *Picea*, in Greek, πίτυς, the classical name.

boidal-oval, rounded or obtuse or shallowly emarginate at the apex, thick in the centre and bevelled off to the sharp edges, slightly undulated, faintly striated, deeply excavated at the base for the seeds. Seed small, wing oval about 3 times the length of the seed itself.

Habitat.—This familiar tree is one of the chief constituents of the great forests of Europe. It is especially abundant in the north, extending within the arctic circle in Lapland and Finland, and forming extensive woods in Russia and Scandinavia. It is found on all the mountain ranges of Europe, but is rare in the Pyrenees; in the Alps it extends to an elevation of about 5500 feet. The tree is absent from Spain, Greece, and the Caucasus, nor does it occur in the British Isles as a native. Cones are said to have been found in the bogs of Ireland, but there seems to be some doubt as to the fact. It is very common in plantations here, having been commonly planted for certainly over 350 years. The flowers appear in May. There is considerable variety in the length of the cones, which are often considerably more elongated than as above described.

The names of this and the following species (*P. Abies*) afford an example of the very rare case in which it appears desirable to set aside the nomenclature of Linnæus in favour of later appellations. It is certain that he determined incorrectly the trees called by the Romans *Abies* and *Picea,* and in fact transposed them in his specific names. We have followed Endlicher and Parlatore in adopting the correction made by Du Roi.

Gren. & Godr., Fl. France, iii, p. 155; Ledebour, Fl. Ross., iii, p. 670; Parlatore, in DC. Prod., xvi, pt. 2, p. 415.

Official Part and Names.—Pix Burgundica; a resinous exudation from the stem of the Spruce Fir, Abies excelsa, *DC.;* melted and strained (B. P.). The resinous exudation from the stem (*Abietis Resina*); melted and strained (*Pix Burgundica*) (I. P.). The prepared resinous exudation from Abies excelsa (U. S. P.).

In the London Pharmacopœia of 1809 it was termed *Pix arida.* In Great Britain and Ireland, the United States, and France, the

term *Pix Burgundica* is restricted to the official resinous exudation of the Spruce Fir; but in other parts of the Continent, excluding France, the name is not simply applied to this purified exudation, but also includes the similar products of other Coniferous plants, and is used synonymously with *Resina alba*.

Until the appearance of the British Pharmacopœia in 1864, the official *Thus* was also always stated to be the spontaneous exudation of *Abies excelsa;* and there can be no doubt that this was a correct description of the original *Thus* of the Materia Medica, but this has long ceased to be imported under that name, though it still comes to us, after being melted and strained, as Burgundy Pitch. The substance now known under the name of *Thus* in this country, is concrete American Turpentine, which is official in the British Pharmacopœia under the name of 'Thus Americanum,' and is described under *Pinus australis*.

Production, Extraction, and Preparation.—According to the authors of Pharmacographia, Burgundy Pitch is produced on a very large scale near Helsingfors, in Finland, and also in the Black Forest in the Grand Duchy of Baden, Austria, and Switzerland. The name of Burgundy Pitch applied to this substance is a complete misnomer, as no such substance has ever been produced in Burgundy. In Finland it is termed *résine jaune*, and in Switzerland *poix blanche*.

In the Grand Duchy of Baden the crude resin (*abietis resina*) is extracted by making longitudinal channels in the stems of the firs at equal distances, one and a half inches wide, and the same in depth. The resin which then exudes is scraped off with an iron instrument, and purified by being melted in hot water and strained. The product thus obtained, which contains much moisture and is opaque, is termed *Wasserharz;* this, by further straining and evaporation of a portion of the water, has its quality improved. In Finland, Burgundy Pitch is prepared from the crude resin obtained from the trunk of the tree, where it appears to exude spontaneously, by melting it in contact with the vapour of water and subsequent straining.

General Characters and Composition.—Pure Burgundy Pitch

is hard and brittle when cold, yet gradually taking the form of the vessel in which it is kept; somewhat opaque; yellowish-brown in colour; fracture clear and conchoidal; odour agreeable and aromatic, especially when heated; taste sweet, aromatic, and without bitterness; and readily soluble in glacial acetic acid or alcohol, but its solubility is very much modified when it contains water or essential oil, or even more so when it contains abietic acid. The crystalline texture frequently noticed in the crude resin is not to be found in the official Burgundy Pitch.

As shown by Maly, the composition of Burgundy Pitch is like that of most other exudations from the Coniferæ, that is, of an amorphous resin, $C_{44}H_{62}O_{41}$, and essential oils, represented by the formula $C_{10}H_{16}$. In their natural state, these pinic juices constitute commercial *turpentine;* or when deprived of a variable proportion of their volatile oil, they are represented by such products as Burgundy Pitch; or if entirely deprived of their volatile oil, by Colophony, Resin, or Rosin. The amorphous resin yields by hydration *abietic acid,* and hence Burgundy Pitch varies in its degree of opacity according to the quantity of water it contains.

Adulteration and Substitution.—But little true Burgundy Pitch is sold in this country, in the United States, or on the Continent, an artificial compound being generally sold instead of it. Thus Flückiger and Hanbury state:—"No drug is the subject of more adulteration than Burgundy pitch, so much so that the very name is understood by some pharmacologists to be that of a manufactured compound. The substance commonly sold in England is made by melting together colophony with palm oil or some other fat, water being stirred in to render the mixture opaque. In appearance it is very variable, different samples presenting different shades of bright or dull yellow or yellowish-brown. Many samples, when broken, exhibit numerous cavities containing air or water; all are more or less opaque, becoming in time transparent on the surface by the loss of water. Artificial Burgundy pitch is offered for sale in bladders; it has a weak terebinthous odour, and is devoid of the peculiar fragrance of the genuine sub-

stance. The presence of a fatty oil is easily discovered by treatment with double its weight of glacial acetic acid, which forms a turbid mixture, separating by repose into two layers, the upper being oily."

Medical Properties and Uses.—When applied to the skin it acts as a slight stimulant; hence, when used in the form of a plaster, as in the official pitch plaster of the British Pharmacopœia, it is a useful application to the chest in chronic coughs and other pulmonary affections, to the loins in lumbago, to the joints in chronic articular affections, and to other parts to relieve chronic local pains of a rheumatic character. Flückiger and Hanbury say, that in Germany, it has also some economic applications, one of which is in the preparation of what is termed *Brauerpech* (brewers' pitch), made by mixing it with colophony or galipot, and which is used in the coating of beer casks.

Per. Mat. Med., vol. ii, pt. 1, pp. 306 & 320; Per. Mat. Med., by B. & R., p. 479; Pharmacographia, p. 557; U. S. Disp., by W. & B., p. 678; Hanbury, in Pharm. Journ., vol. ix, ser. 2, p. 162; Morel, in Pharm. Journ., vol. viii, ser. 3, p. 342.

DESCRIPTION OF PLATE.

Drawn from a specimen gathered at Chamounix, Savoy; the flowers added from Berg and Schmidt.

1. A branchlet with cones.
2. Lower, and—3. Upper surface of mature cone-scale.
5. A seed.
4. Section of the same.
6. A twig with male catkins.
7. An anther.
8. A female flower-cone.
9. Carpellary scale and bract.
10. The tree (very much reduced).

(4 and 7 enlarged.)

D Blair F.L.S. ad. nat. del. et lith.

PINUS ABIES, *Du Roi.*

M & N. Hanhart i

N. Ord. Coniferæ.
Tribe *Pineæ*.
Genus Pinus, *Linn.*

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262. Pinus Abies,* *Du Roi, Observ. Botan., p.* 39 (1771).

Silver Fir. Sapin.

Syn.—P. Picea, *Linn. & auct. plur.* P. pectinata, *Lam.* Abies vulgaris, *Poir.* A. alba, *Mill.* A. pectinata, *DC.*

Figures.—Woodville, t. 3; Nees, Suppl.; Berg, Chacterist., t. 19, fig. 166; Berg & Sch., t. 17 d; Lambert, Ill. Gen. Pinus, ed. 2, t. 32; Reich., Ic. Fl. Germ., xi, t. 533; Nees, Gen. Fl. Germ.

Description.—A large tree, attaining a height of 90, 100, or even more feet, with a very straight trunk and a pyramidal but rounded head, with very numerous whorled branches which spread horizontally but do not droop downwards; bark smooth, grey or white, shining and silvery on the smaller branches. Leaves numerous, solitary, closely set on all sides of the branches, but spreading more or less completely in two ranks horizontally, and many thus curved or twisted at the base, ½—1 inch long, linear, flat, obtuse and generally emarginate at the apex (the young ones sometimes acute), smooth, the upper surface dark green and polished (bright green when young), the under surface with two longitudinal white lines, persistent. Male catkins numerous in the axils of the leaves of the previous year and slightly exceeding them, shortly stalked, surrounded at the base with empty bracts; anthers crowned with a broad pointed crest, 2-celled, dehiscing by a transverse fissure. Female flower-cones very shortly stalked or sessile, few, on the branchlets of the previous year, axillary or rarely terminal, erect, oblong; bracts roundish, with a denticulate edge and a long terminal linear-subulate sharp spreading point, green; carpellary scales about half as long as the rounded portion of the bracts, broad, with an entire rounded margin. Ripe cone erect, large, 5 or 6 inches long, often somewhat curved, oblong,

* *Abies*, in Greek ἐλάτη, the classical name.

blunt at both ends, cylindrical, pale greyish or reddish-green, axis woody, persistent, carpellary scales much enlarged and dilated, densely imbricated, thin, scarcely woody, flat, not excavated at the base, deciduous from the axis when ripe with the adherent persistent bracts which project considerably beyond them. Seeds with a large triangular wing.

Habitat.—The Silver Fir has not so extensive a range as the Spruce and does not reach the northern countries of Europe. In the mountain ranges of France, Switzerland, Spain and Italy it is common, but does not attain to such high elevations as *P. Picea*. It is particularly abundant in the Vosges mountains, where it forms large forests. Towards the south-west the Silver Fir extends to Greece, Turkey, and the mountains of Asia Minor and the Caucasus. It is frequently grown in England, having been introduced here before the year 1603.

A variety is known to arboriculturists with pendulous branches.

The tree flowers in May, and the cones, which are produced very sparingly in most localities, are ripe in October of the same year. After the scales and seeds have fallen away, the persistent woody axis of the cone remains as an erect spine.

On the confusion and crossing of the names *Abies* and *Picea* see under the last species.

Gren. & Godr., Fl. France, iii, p. 155; Ledebour, Fl. Ross., iii, p. 669; Parlatore, in DC. Prod., xvi, pt. 2, p. 420; Lindl., Fl. Med., p. 554.

Part Used and Names.—Terebinthina Argentoratensis; the turpentine obtained by incision from the stem. It is not official in the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States. It was, however, formerly recognised in the London Pharmacopœia, but omitted from that volume as far back as 1788. It is commonly termed *Strassburg Turpentine;* and by the French *Terebinthine au citron.*

Extraction.—The turpentine of this plant, like that from *Abies balsamea*, which is official in the British Pharmacopœia under the name of *Terebinthina Canadensis*, is contained in irregular-shaped

lacunæ or receptacles which are formed in the bark of the stem and branches, and which by distending cause swellings in the suberous layer. The peasantry collect it by puncturing or incising these receptacles with sharp-pointed hooks, and receiving the oleo-resinous juice which then escapes, in bottles; they subsequently purify it by filtration through a rude kind of bark funnel. As each of the receptacles only contains one or two drops, the process is a tedious one. At the present day it is only collected to a very limited extent; and principally in the Vosges, and the Bernese Jura.

General Characters and Composition.—As seen in commerce, it is a pale yellow transparent liquid, very much resembling the official Canada turpentine or balsam, but without the fluorescent appearance of that substance. Its odour is very agreeable and citron-like, hence the French name of *Terebinthine au citron;* its taste, although very slightly acrid and bitterish, is less so than that of Canada turpentine. It is levogyre; and has the specific gravity of distilled water. It is soluble, like Canada turpentine, in ether, chloroform, and benzine, each of the solutions having an acid reaction. When spread out in thin layers and exposed to the air, it completely solidifies into a transparent varnish; and when mixed with about one sixth of its weight of magnesia, it acquires a pilular consistence.

Strassburg turpentine is an oleo-resin, but the proportion of volatile oil it contains, like that of Canada turpentine, would appear to be very variable. A sample examined of late years by Flückiger, yielded 72·4 per cent. of a *brittle transparent resin,* soluble in glacial acetic acid; and 24 per cent. of *essential oil.* The oil boils at about 325°; and although when recent it is levogyre, after keeping for some time it becomes dextrogyre. It has the same odour as the oleo-resin.

Rochleder found in the leaves of this Fir, a peculiar sugar, closely resembling mannite, to which he gave the name *abietite;* and when the cones are distilled with water, a very fragrant volatile oil is obtained, which is called in France *essence de templine.* Its composition is the same as that of the oil derived

from the crude oleo-resin or Strassburg turpentine of the stem; but unlike that oil it is powerfully levogyre.

Medical Properties and Uses.—In its properties it closely resembles common turpentine, over which it has the advantage of an agreeable odour. It is, however, but very little employed at the present day, although formerly highly esteemed.

Per. Mat. Med., vol. ii, pt. 1, p. 305; Pharmacographia, p. 555; U. S. Disp., by W. & B., pp. 863 and 866; Morel, in Pharm. Journ., vol. viii, ser. 3, p. 21.

DESCRIPTION OF PLATE.

Drawn from the specimen cultivated in the Royal Botanic Gardens, Regent's Park; the fruit added from a specimen in the Kew Museum.

1. A female cone.
2, 3. Bract and carpellary scale.
4. A nearly ripe cone.
5. Bract and scale.
6. Upper surface of scale.
7. A seed.
8. A branchlet with leaves.
9. A leaf.
10. A tree.

(2, 3, 9, enlarged.)

D.Blair F.L.S. ad sicc. del. et lith.

PINUS BALSAMEA, *Linn.*

M & N Hanhart imp.

N. Ord. CONIFERÆ.

Tribe *Pineæ*.

Genus Pinus, *Linn.*

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263. Pinus balsamea, *Linn., Sp. Plant., ed.* 1, *p.* 1002 (1753).

Balsam Fir. Balm of Gilead Fir. American Silver Fir.

Syn.—Abies balsamea, *Mill.* A. balsamifera, *Mich.* Picea balsamea, *Loud.*

Figures.—Lambert, Ill. Gen. Pinus, ed. 2, t. 33, cop. in Steph. & Ch. t. 74, and Woodville, vol. v; Nees, t. 82; Michaux, N. Amer. Sylva, iii, t. 150.

Description.—Usually a small tree about 20—40 feet high, but sometimes considerably taller, with a slender trunk and numerous horizontally spreading branches which form a pyramid; bark smooth, reddish-grey when young. Leaves numerous, rather crowded, somewhat spreading, sessile, solitary, about $\frac{3}{4}$ inch long, linear, blunt, entire, flat, stiff, smooth, bright green above, whitish beneath, with the midrib very prominent, persistent but articulated to the stem by a circular, flattened base placed obliquely to the upper surface. Male catkins in the axils of the leaves of the previous year and shorter than them, somewhat drooping, fusiform, blunt, pollen bright yellow. Anthers terminated by an acute or bifid appendage. Female cones solitary, erect, nearly sessile, bracts roundish-oval, entire or denticulate, furnished at the apex with a long straight point. Carpellary scales suborbicular, much shorter than the bracts. Cones about 4 inches long, oblong, cylindrical, blunt, erect, scales as long as, or longer than, the unchanged bracts, rounded, puberulous, purplish-blue. Seeds with a large wing.

Habitat.—The Balsam Fir, or "Balsam" as it is often called, is a well-known inhabitant of the cold and swampy districts of Labrador, Nova Scotia, and other parts of Canada, as far north as 62°; it extends in the northern and western States, as far south as Pennsylvania, and along the mountains even to Virginia. The tree

does not form woods of itself, but occurs abundantly scattered over the country amongst other species; it is especially found near the coast. When young it is a very handsome conifer, but it soon decays and becomes unsightly; it is, however, very hardy and much cultivated in arboretums in this country. The *Abies Hudsonia* of gardeners is a dwarf stunted form. The cones are invariably directed vertically upwards, and the bracts never exserted beyond the scales.

Hook., Fl. Bor.-Amer., ii, p. 163; A. Gray, Man. N. U. States, p. 471; Michaux, N. Amer. Sylva, iii, p. 52; Parlatore, in DC. Prod., xvi, pt. 2, p. 423; Lindl., Fl. Med., p. 554.

Official Part and Names.—TEREBINTHINA CANADENSIS; the turpentine obtained by incision from the stem of Abies balsamea, *Aiton* (B. P.). The turpentine obtained from the stem by incision (I. P.). TEREBINTHINA CANADENSIS; the liquid oleo-resin obtained from Abies balsamea (U. S. P.). It is commonly known under the names of Canada Balsam, Canada Turpentine, Balsam of Fir, and Balsam of Gilead. It is improperly called Canada Balsam and Balsam of Fir, as it contains neither benzoic nor cinnamic acid, the presence of one of which is regarded by nearly all pharmacologists, and by the authors, as a necessary constituent of a balsam. The name of Balsam of Gilead has been applied to it on account of its agreeable odour, but this term is altogether incorrect, as the true Balsam of Gilead is derived from a species of *Balsamodendrum*, probably *B. Opobalsamum*, as described by us in treating of that plant. It is properly designated Canada Turpentine, as the name of turpentine is commonly applied to a liquid or solid vegetable secretion, which consists of a resin combined with the peculiar essential oil, called oil of turpentine.

Extraction and Commerce.—Canada turpentine is contained in receptacles, which are formed under, and in, the bark of the trunk and branches of the tree, and which by distending cause protuberances in the suberous layer. The turpentine is collected by puncturing or incising these receptacles, when the oleo-resinous juice runs out, and is collected in a bottle or other suitable vessel; this is sub-

sequently filtered to remove impurities. The mode in which it is largely collected in the province of Quebec, has been recently described by Mr. Brunet, from whose account the following details are taken :—The whole family of balsam gatherers go into the woods in the Laurentine mountains at a distance of from seven to ten miles from the villages. There they encamp for two months ; the mother remains in the camp to do the cooking and strain the turpentine, and it is she who transports it, upon her back, in canisters of five gallons each to the village, where she sells it in exchange for flour and pork, which she carries back with her when she returns to the camp. The father, with his boys, goes to pierce the trees, each furnished with a small can like an ordinary pewter pot, and having a tube proceeding from it at the top. This tube is of iron, sharpened ; and with this portion of the instrument the receptacles of turpentine are pierced, one by one, the liquid flowing down the interior of the tube until the vessel is full. The children mount into the branches while the father works about the lower part of the tree. A large tree will yield as much as a pound of turpentine ; but one with another the yield of each tree is not usually more than eight ounces. The father, with the help of two children, can gather from sunrise to sunset about a gallon of turpentine, but the man who works alone has done a good day's work when he has collected half a gallon. One cannot gather the turpentine when it rains, or even on the same day in which rain falls, for the branches then let fall drops of water, which, mixing with the turpentine, render it milky and unsaleable. The collection is made from the 15th of June, or about the time the snow disappears from the mountains, up to the 15th of August or 1st of September, the date when the snow usually begins to fall, or the weather turns cold, and the turpentine no longer flows. Near the villages and upon partially cleared land it is gathered in May, but at this time only in small quantities. It is only the poorest inhabitants and the Indians who do this business. The average amount collected annually appears to be about 3000 gallons, but as much as 5000 gallons have been obtained in one year. A tree should not be pierced two years in succession,

indeed, it requires rest for two or three years before being tapped again, and then it always yields very much less than the first time.

Canada turpentine is principally obtained in Lower Canada, and is exported from Quebec and Montreal in kegs or large barrels. Some also is said to be collected in the State of Maine.

General Characters and Composition.—When quite fresh Canada turpentine is turbid, but by exposure to light it soon becomes clear and transparent. As seen in commerce when freshly imported, its colour is pale yellow with a greenish tinge; it is transparent, of the consistence of thin honey, with a peculiar, agreeable, aromatic odour, and a slightly bitter, feebly acrid, but not disagreeable taste. By keeping it gradually thickens, and becomes somewhat darker in colour, but it retains its transparency; and by exposure to the air for some time, it dries slowly into a solid, transparent, adhesive varnish. When heated to a temperature of about 392°, and examined in direct sunlight, it exhibits a greenish fluorescence, like other turpentines, and copaiva. The same greenish fluorescence may also be noticed, although to a slighter extent, if it be examined at ordinary temperatures. Its specific gravity is 0·998 at about 58°. When mixed in the proportion of four parts of the turpentine to one of benzine, it is dextrogyre. It is readily soluble in chloroform, benzine, ether, and amylic alcohol, each of the solutions having an acid reaction. It is only partially soluble in absolute alcohol, or glacial acetic acid. When mixed with about a sixth of its weight of magnesia, it becomes of a pilular consistence.

Canada turpentine is an oleo-resin, but the proportion of volatile oil and resin which it contains varies in different samples. A recent analysis of Flückiger, indicates 24 per cent. of *volatile oil*, 59·8 per cent. of *resin* soluble in absolute alcohol, and 16·2 per cent. of *resin* insoluble in absolute alcohol, but soluble in ether. Bonastre found only 18·6 per cent. of volatile oil; and Wirzen but 16 per cent. The latter chemist also obtained from it three amorphous resins, of which one had the

composition of abietic acid. Flückiger also found that while Canada turpentine is feebly dextrogyre, its constituent volatile oil is lævogyre, while its resin is dextrogyre. Pereira, however, states that both the resin and volatile oil are lævogyre.

Substitution.—In the United States market, during a time of scarcity of true Canada turpentine, a kind of oleo-resin from Oregon was sometimes substituted for it, but it did not meet with a ready sale, and its botanical source is unknown.

Medical Properties and Uses.—In its properties it resembles the other turpentines. It is, however, but little employed; although occasionally, and then generally in the form of a pill, in mucous discharges from the genito-urinary organs, in chronic catarrh, and in chronic rheumatism. In the British Pharmacopœia, and the Pharmacopœia of India, it is used as an ingredient in blistering paper and flexible collodion. It is highly valued, and is much employed as a menstruum, for mounting microscopic objects, as it always remains uncrystalline and transparent. It is also used by varnish makers; and by opticians as a cement.

Per. Mat. Med., by B. & R., p. 481; Pharmacographia, p. 553; U. S. Disp., by W. & B., p. 865; Pereira, in Pharm. Journ., ser. 1, vol. v, p. 67; Julius Morel, in Pharm. Journ., ser. 3, vol. viii, p. 22; Proc. Amer. Pharm. Assoc., vol. xx, p. 119, vol. xxi, p. 433, and vol. xxiv, p. 337.

DESCRIPTION OF PLATE.

Drawn from a cultivated specimen in the British Museum; the male flowers and cone added from Lambert.

1. A twig with male catkins.
2. A single catkin.
3. An anther.
4. A branch with female flowers.
6. Upper—and 6. Under surface of a bract.
7. A ripe cone.
8, 9, 10. Scales of the cone with seeds.
11. A seed.
12. Base of leaves.

(3, 5, 6, 12, enlarged.)

D Blair F.L.S ad nat. del. et lith.

PINUS CANADENSIS, *Linn.*

M & N Hanhart imp.

N. Ord. CONIFERÆ.
Tribe *Pineæ*.
Genus Pinus, *Linn.*

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264. Pinus canadensis, *Linn., Sp. Plant., ed.* 2, *p.* 1421 (1762).

Hemlock Spruce.

Syn.—Abies canadensis, *Mich.*

Figures.—Nees, t. 83; Lamb., Ill. Gen. Pinus, ed. 2, t. 35; Michaux f., N. American Sylva, iii, t. 149.

Description.—A large tree attaining a height of 70—80 feet, pyramidal in form with a straight trunk and horizontal branches, the upper ones pendulous at the apex, the young twigs slender, with longish spreading hairs, bark grey, smooth. Leaves numerous, solitary, irregularly crowded, but with a tendency to spread in two ranks, ½—¾ inch long, with a very short slender petiole, linear, flat, obtuse at both ends, stiff, green and shining above, whitish beneath, downy when young. Male catkins very small, solitary in the leaf-axils, stalked, globose; anthers with a reniform apiculate crest. Ripe cones small, pendulous at the extremity of the branches, about ¾ inch long, broadly ovoid, blunt, pale brown, carpellary scales much enlarged and dilated, few, large, strongly imbricated, oval-roundish, very obtuse, thin but woody or leathery, sharp at the edge, convex on the bark; bracts broadly ovate, truncate, ciliate-denticulate, 3 or 4 times shorter than the scales. Seeds pale with a long thin wing.

Habitat.—This species of Spruce Fir is a native of a very extensive area in North America, extending from Nova Scotia, Hudson's Bay, and New Brunswick, through Canada and the United States, as far south as North Carolina. It forms with *P. nigra* vast forests. When well grown it is a very graceful tree, but the lower branches are liable to be broken off from the weight of snow they bear in the winter; it is particularly beautiful in

spring. The habit is not unlike that of the yew, but lighter and more lax; it flowers in May, and the small cones, like hop-catkins, are ripe in October. It is grown in many arboretums in England, having been introduced about a century ago by Peter Collinson.

Parlatore, in DC. Prod., xvi, pt. 2, p. 428; A. Gray, Man. Bot. N. U. States, p. 471; Hook., Fl. Bot. Amer., ii, p. 164.

Official Part and Names.—Pix Canadensis; the prepared resinous exudation from Abies Canadensis (Michaux) (U. S. P.) It is commonly known as Canada Pitch, Hemlock Pitch, and Hemlock Gum. It is not official in the British Pharmacopœia, or the Pharmacopœia of India.

Collection and Preparation.—The concrete turpentine, which is official under the name of Canada Pitch, is either obtained by making incisions into the trunk of the tree yielding it, and afterwards collecting the exuded juice when it has concreted on the bark; or, as but little juice exudes from incisions thus made, the more usual mode is to collect the hardened juice, which exudes spontaneously from the full-grown trees, when they are about or have begun to decay. In the latter case the bark thus encrusted is torn from the trees, and after having been broken into pieces, boiled in water; and the melted pitch as it rises to the surface is skimmed off, and afterwards purified by again heating it in water and straining. As thus prepared and brought to the shops, it is in dark-coloured masses, which still contain diffused through their substance a variable proportion of small pieces of bark and other impurities, from which it is subsequently purified by melting and straining, and it then constitutes the official Canada Pitch of the Pharmacopœia of the United States.

General Characters and Composition.—Canada pitch, as thus prepared, varies in consistence at different seasons; thus, in cold weather it is hard and brittle, but in warm seasons it softens and takes the shape of the vessel in which it is contained. It is also readily softened by the warmth of the body, and becomes adhesive; it melts at 198°. It has a dark yellowish-brown colour when first obtained, but by exposure to the air the colour deepens,

and becomes almost black. It has very little taste, and only a slight peculiar odour.

It consists of *resin* and a minute quantity of *volatile oil.* It is supposed to be of a similar nature to Canada Turpentine obtained from *Pinus balsamea,* but at present nothing definite is known respecting it, as it has not been sufficiently examined.

Medical Properties and Uses.—When applied locally, it is slightly stimulant, like Burgundy Pitch, and is therefore employed for similar purposes. The objection to its use is, that it softens so readily as to render it inapplicable at some seasons; and even when used in cold weather as a plaster, the heat of the body often prevents it being well retained in its place.

Other Products of Pinus canadensis.—In the County of New York a volatile oil is obtained by distillation from its leaves; this is known as Oil of Spruce or Oil of Hemlock. It has been used to procure abortion; and like some other volatile oils from coniferous plants it is capable of producing dangerous effects on the life of the female.

The inner bark is a powerful astringent, and it is sometimes employed on this account medicinally in the United States. From the same cause it forms a valuable tanning material, which is much used in the northern parts of the United States. An extract obtained from it is said to have similar properties and effects to that of extract of rhatany, and therefore applicable as a medicine to like purposes.

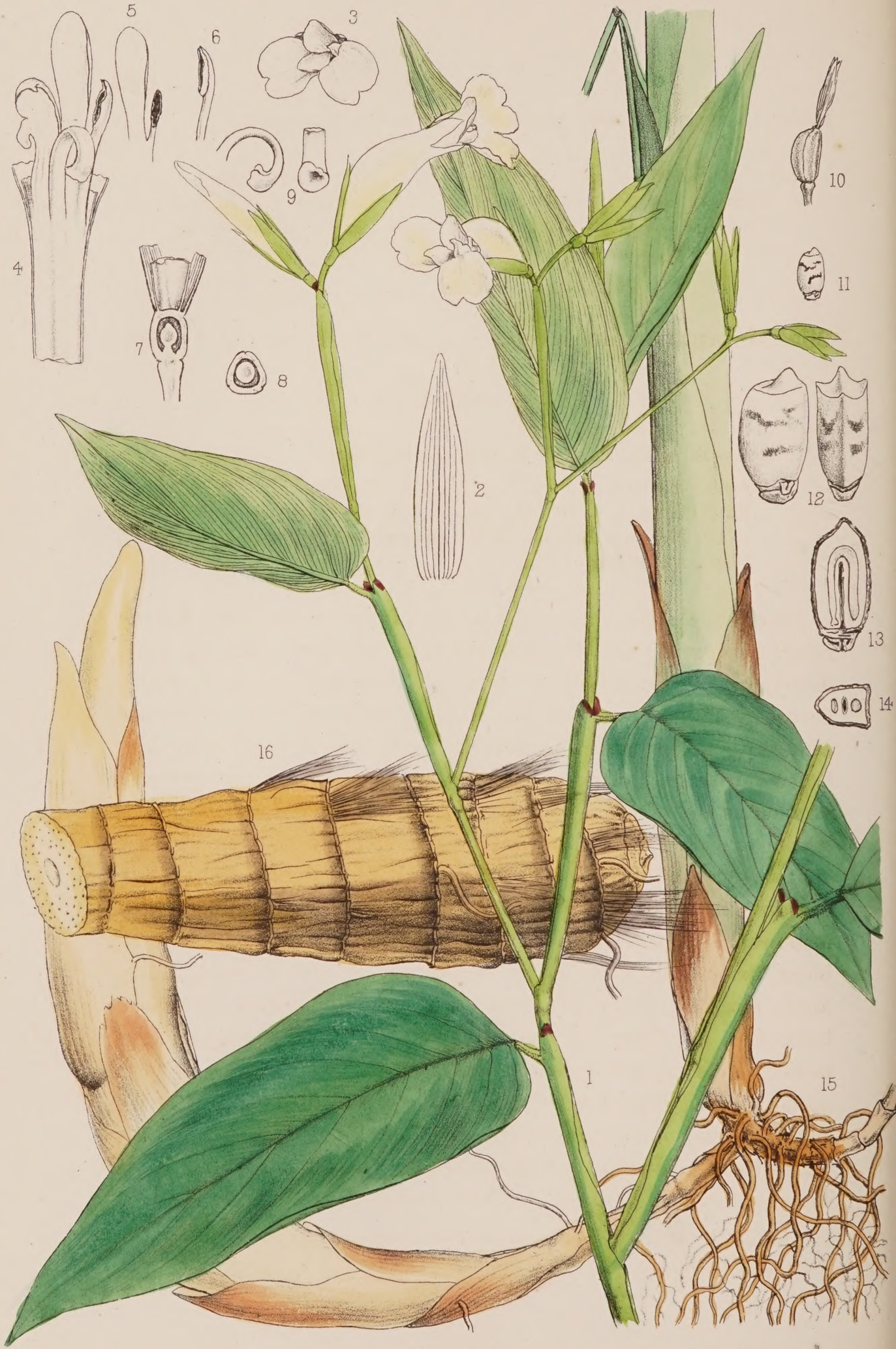
U. S. Disp., by W. & B., p. 678; Wood's Ther. & Pharm., vol. ii, p. 749; Journ. Phil. Col. of Pharm., vol. ii, p. 18; Amer. Journ. Pharm., Jan., 1860, p. 29, and May, 1866, p. 214; New York Journ. of Med., vol. viii, p. 184.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum collected by Rugel in Carolina; the fruit added from Lambert.

1. A twig with male catkins.
2, 3. Male catkins.
4. A branch with ripe cones.
5. Outer; and 6. Inner side of a cone-scale.
7. A seed.

(3 enlarged.)



D.Blair F.L.S. ad nat.del.et lith.

M&N.Hanhart im

MARANTA ARUNDINACEA, *Linn.*

N. Ord. CANNACEÆ. Lindl., Veg. Kingd., p. 168; Le Maout & Dec., p. 757.

Genus **Maranta**,* *Linn.* Endlicher, Gen. Plant., p. 266. Körnicke, in Bull. Soc. Imp. Nat. Moscou, xxxv (1862), pp. 1—73. Species about 40, natives of tropical America and (rarely) Asia.

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265. Maranta arundinacea, *Linn., Sp. Plant., ed.* 1, *p.* 2 (1753).

Arrowroot.

Syn.—M. indica, *Tussac.* M. ramosissima, *Wall.*

Figures.—Redouté, Liliac., i, t. 57, cop. in Hayne, ix, t. 25; Tussac, Fl. Antilles, i, t. 26 (*M. indica*), cop. in Hayne, ix, t. 26; Nees, tt. 69, 70; Bot. Mag., t. 2307; Roscoe, Scitamineæ, t. 25; Wall., Plant. Asiat. Rar., t. 286.

Description.—An herbaceous perennial, with a creeping, definite rootstock, giving off, beneath the terminal buds, lateral, solid, fleshy, cylindrical, thickened branches (tubers), curving upwards, covered with large, imbricated, thin, pale brown or white scales, and afterwards ringed with their scars. Flowering stem reaching 5 or 6 feet in height, slender, much branched, smooth, compressed, swollen at the nodes, mostly covered with the sheaths of the leaves, branches wide spreading. Leaves numerous, with long sheaths, split completely down one side, and either enveloping the stem or standing a little away from it, smooth, striate, with somewhat membranous margins, and terminating above in two prominent, blunt, purple auricles, blade spreading, set on a short, thick, hard, rounded, finely pubescent petiole, ovate-oblong or ovate-lanceolate, the lower reaching 10 inches in length, the upper 2—4 inches, acute or acuminate, entire, glabrous or nearly so on both surfaces, with a prominent thick midrib which ceases before the apex, and very numerous slender, curved, quite parallel lateral veins, pale green, somewhat glaucous beneath, convolute in vernation. Flowers shortly stalked, slightly nodding, pedicels somewhat

* Named by Plumier in honour of Bartolommeo Maranta, a physician of Venosa in Basilicata, who died at Naples in 1559.

thickened beneath the flower, arranged in pairs at the ends of the rather long, slender, divaricate branches terminating the long peduncles, which are given off opposite the axils of the upper leaves; bracts long, sheathing, blunt, at the base of the branches. Sepals 3, superior, equal, oval-oblong, subobtuse, membranous, delicately veined. Petals and stamens combined below into a tube, which is about half as long again as the sepals, curved and gibbous on the back, nearly straight in front, divided at the end into 3 equal, broadly oval-oblong, blunt outer segments (corolla), and 5 inner unequal divisions (petaloid staminodes) exceeding the corolla and arranged in two whorls, the outer whorl of 2 nearly equal, large, labelliform, bifid staminodes, the inner whorl of 3 much smaller, unequal ones, of which the 2 smaller are partially united, recurved, and the larger one somewhat spathulate, erect, bearing on one side a free, erect, small, one-celled anther. Ovary inferior, very bluntly trigonous, smooth, 1-celled, with a single erect ovule seated on a thick stalk-like placenta, style united with the upper surface of the flower-tube for nearly its whole length, the terminal part free, somewhat triangular, curved over into a hook, stigma truncate, slightly dilated, perforated in the centre, with a prominent lip round the mouth. Fruit small, not $\frac{1}{2}$ inch long, crowned with the remains of the sepals, smooth, oblong-ovoid, pericarp leathery, dehiscing from the top into 3 valves. Seed solitary, erect, ovoid, irregularly pointed or shortly beaked at the top, slightly compressed, testa very hard, smooth, mottled, a small hollow canal runs up the centre of the seed from the base for about $\frac{3}{4}$ of its length; embryo long, strongly doubled over at its centre in a horse-shoe shape, the radicle at the hilum, the cotyledonary end somewhat shorter; endosperm abundant, horny.

Habitat.—In the West Indian Islands, especially in Jamaica, Dominique, St. Vincent, and Haiti, the Arrowroot is doubtless indigenous, and perhaps also in Mexico and other parts of central America. It is largely cultivated in parts of Brazil, in Georgia, and in the Bermudas, but is very doubtfully native to those countries. In the old world the plant grows in Bengal, Java, the Philippines, &c., either wild or cultivated, and in Mauritius, at

Natal, and on the west coast of Africa. The Indian plant has been described as a distinct species (*M. indica*), but except that the leaves are said to be narrower and sharper and always smooth, characters of very slight importance, no difference can be found to distinguish it.

Arrowroot was introduced into England by Houston about 1732; it is a stove plant now grown in all our botanic gardens, and flowering sparingly in autumn.

Grisebach, Fl. W. Indies, p. 605; Lunan, Hort. Jamaic., i, p. 30; Körnicke, l. c., p. 34; Lindley, Fl. Med., p. 569.

Official Part and Name.—MARANTA; the fecula of the rhizome (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India.

Origin of Name.—This starch is commonly known under the name of Arrowroot, a term which, according to Sloane, was originally applied to it from the employment of the mashed rhizomes of the plant from which it is obtained, by the native Indians, as an application to wounds produced by poisoned arrows; but Martius states that the name is derived from that of the Aruac or Aroaquis Indians of South America, who call the finest fecula they obtain from the Mandioc plant (*Manihot utilissima*, Pohl.) *Aru-aru*. The authors of the Pharmacographia dispute this, and say, although it is true that *Maranta arundinacea* is known at the present day in Brazil as *Araruta*, the name is a corruption of the English word *arrowroot*, the plant, according to general report, having been introduced. Others regard the explanation of Martius as very probable, "the word 'aru' signifying meal or flour, and they are of opinion that 'ara-ruta,' which means mealy root, is the word from which arrowroot is derived." The term arrowroot is also now frequently used to indicate other starches, as, for instance, Brazilian arrowroot from *Manihot utilissima*, Tahiti arrowroot from *Tacca oceanica*, Portland arrowroot from *Arum maculatum*, and East Indian arrowroot from *Curcuma angustifolia* and other species of Curcuma. The latter kind is described by us under Curcuma longa. It should be noticed in reference

to this that the West Indian plant (*Maranta arundinacea*), now being treated of, is also cultivated in the East Indies, and as the starch obtained therefrom is occasionally exported, it might with equal propriety be called East Indian arrowroot, hence, to avoid confusion, the original West Indian arrowroot is now commonly designated Maranta Starch or Maranta Arrowroot, or simply arrowroot.

Extraction, Commerce, and Kinds.—The starch is extracted from the rhizomes when they are about ten or twelve months old, and the process adopted in Jamaica, is given by Pereira, as follows :— The rhizomes are dug up, well washed in water, and then beaten in large deep wooden mortars to a pulp, which is then thrown into a large tub of clean water. The whole is then well stirred and the fibrous part wrung out by the hands and thrown away ; the milky liquor is afterwards passed through a hair-sieve or coarse cloth, and suffered to settle, and the clear water is then drained off. At the bottom of the vessel there is then left a white mass of starch, which is again mixed with clean water and drained ; and lastly, the mass is dried on sheets in the sun, and is pure starch. In other parts the rhizomes are first deprived of the scales which cover them, then washed and crushed in a mill, or grated by a rasping machine to a pulp, after which the pulp is well washed on sieves, or in properly constructed machines, in order to remove the starch. The starch is then mixed with pure water, and allowed to settle, after which it is dried with a gentle heat. In drying, the greatest care is taken to exclude dust, insects, or anything which will impart colour or taste to the starch, and thus deteriorate its quality. The rhizomes yield about one fifth of their weight of starch.

Arrowroot is imported from several of the West Indian Islands, as Bermuda, St. Vincent, Jamaica, &c., and also from Natal, Sierra Leone, Brazil, East Indies, &c. It is usually distinguished by the name of the island, or place, or country, from whence obtained, as, for instance, Bermuda arrowroot, St. Vincent arrowroot, Jamaica arrowroot, Natal arrowroot, &c. Bermuda arrowroot is the most esteemed kind, and fetches the highest price, but of late years the production has been declining, and is now but very limited. The

production of arrowroot has also declined of late years in the West Indian Islands generally, except in the Island of St. Vincent, from which our supplies are now chiefly derived; but a considerable proportion is also imported from Natal. The latter kind, which has been fully described by Greenish, differs, however, "in its appearance under the microscope from the produce of any other Maranta known in commerce," and hence, although its source is said to be from *Maranta arundinacea*, this, as yet, has not been positively determined.

General Characters and Composition.—Arrowroot or Maranta starch is white, odourless, and tasteless, and is either found in the form of a powder, or of more or less aggregated masses, which rarely exceed a pea in size. When pressed between the fingers it feels firm, and when rubbed it emits a faint crackling sound. When viewed by a magnifying lens it is seen to consist of glistening granules; these when examined by the microscope are described by Pereira as "convex, more or less elliptical, and moderately uniform in size. Their shape is more or less irregular, but often oblong, or usually somewhat ovate-oblong, frequently obscurely triangular, or oyster-shaped, or mussel-shaped. The rings are very evident, though fine. The nucleus or hilum is usually most distinct, and generally placed towards one end of the granule; it is normally circular, but frequently cracked in a linear or stellate manner."

Arrowroot has a similar composition to that of other starches.

Substitutions and Adulterations.—From the high price of Maranta starch, other cheaper starches are sometimes substituted for, or mixed in variable proportions with it, as, for instance, sago meal, potato starch, rice starch, Brazilian arrowroot, &c. According to the German Pharmacopœia, the presence of foreign starches in arrowroot is detected by the formation of a jelly upon agitating the sample with ten parts by weight of a mixture of two parts of hydrochloric acid (sp. gr. 1·12) and one part of water. Calmberg, and subsequently E. Schaer, have, however, shown that this test cannot be relied on, as many samples of genuine arrowroot will yield a jelly when thus treated. Schaer, however, states that the

test never fails in the detection of potato starch, from which the acid develops a very characteristic odour, resembling that of French beans. The microscope in the hands of a skilful observer, however, never fails to detect these frauds.

Medical Properties and Uses.—Arrowroot possesses demulcent and nutritious properties. It is very well adapted for the diet of the sick and convalescent, and is also much used as a food for infants when weaned. It is a valuable demulcent in bowel complaints and diseases of the urinary organs. The jelly formed by boiling arrowroot in water is more tenacious than that of any of the other starches, except Tous les Mois, which is described under Canna edulis. Arrowroot is also an agreeable article of food in the form of pudding or blanc mange.

The mashed rhizomes of the arrowroot plant have been employed by the South American Indians and others to counteract the effects of wounds caused by poisoned arrows. The expressed juice of the rhizomes has also been stated to be an antidote to poisons taken into the stomach, and to the bites of venomous insects and reptiles.

Per. Mat. Med., vol. ii, pt. 1, p. 225; Pharmacographia, p. 569; U. S. Disp., by W. & B., p. 550; Proc. Amer. Pharm. Assoc., vol. vii (1858), p. 332, and vol. xxiv, pp. 125, 310, and 739; Simmonds, in Pharm. Journ., vol. iii, ser. 3, p. 834, from Journal of the Society of Arts; Greenish, in Year Book of Pharmacy (1875), p. 529; Journ. de Pharm., ser. 3, vol. ii, p. 246; Year Book of Pharm. (1876), p. 197; Calmberg, Archiv der Pharm., 1875 (3), p. 352; Schaer, Archiv der Pharm., 1875 (4), p. 97; Greenish, in Pharm. Journ., vol. vii, ser. 3, p. 169.

DESCRIPTION OF PLATE.

Drawn from a plant in Kew Gardens; the fruit added from a specimen in the British Museum from Formosa; the rhizome from one in the museum of the Pharmaceutical Society. 1. Portion of a flowering plant. 2. A sepal. 3. Front view of flower. 4. Portion of flower-tube with the innermost staminodes. 5. The anther-bearing staminode. 6. The anther. 7. Vertical, and—8. Transverse section of ovary. 9. Stigma. 10. Fruit. 11, 12. Seeds. 13. Vertical—and 14. Transverse section of a seed. 15. Base of the flowering-stem and branch of the rhizome. 16. Portion of mature rhizome. (2, 4–9, 12—14 enlarged.)

D. Blair ad nat. del. et lith.

M & N. Hanhart imp.

CANNA EDULIS, *Ker.*

N. Ord. CANNACEÆ.

Genus Canna,* *Linn.* Bouché, in Linnæa, xviii, p. 483. Species about 60 or more, natives chiefly of the tropical and warmer parts of America.

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266. Canna edulis, *Ker, in Bot. Register,* ix, t. 775 (1823).

Achira (Peru). *Meeru* (Brazil).

Syn.—C. indica, *Ruiz & Pav.* (non *Linn.*). C. discolor, *Lindl.?*

Figures.—Bot. Reg., t. 775 and ? 1231; Bot. Mag., t. 2498; Roscoe, Scitamineæ, 5th plate.

Description.—An herbaceous perennial with a large, creeping, fleshy, branched, definite rhizome, with thick, nodular, tuberiform joints, ringed with the brown fibrous remains of the leaves of previous years. Roots long, cylindrical, rather thick, unbranched, fibrous. Flowering stems terminal, erect, 8 feet high, somewhat compressed, smooth, solid, green, triangular in the upper part. Leaves very large, alternate, lower ones on long stalks, upper ones sheathing, broadly oval- or ovate-oblong, attenuate at both ends, smooth, bluish-green, with a broad strong midrib, and numerous, curved, parallel, prominent, secondary nerves. Flowers few, in pairs, nearly sessile, erect, arranged in a rather close, short, racemose inflorescence at the end of the stem; a single bract below each pair of flowers, ovate, blunt, membranous and crumpled, purplish-pink, persistent, and two small opposite ones below the ovary of one of the flowers. Sepals 3, superior, slightly unequal, ovate, blunt, imbricate, greenish. Petals 3, superior, alternate with the sepals, and three times as long as them, erect, lanceolate, concave, very acute, red. Andrœcium of 5 superior petaloid staminodes exceeding the true petals, and appearing to constitute the corolla, imbricated in (irregularly) 2 rows, unequal, bright scarlet, yellowish below; the 3 outer at the back of the flower, erect, the longest nearly 3 inches long, all oblong-spathulate, blunt, entire; the 2 inner dissimilar, one curved over the front of the flower, forming a sort of lip, and internally constituting the floor of the flower,

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* *Canna,* Greek κάννα, a reed or cane.

the other bearing an anther on one side in contact (in the bud) with the front of the style, round which this staminode is folded, the upper part recurved, the base fused with the posterior surface of the style; anther apparently 1-celled, dehiscing down the centre, pollen yellowish-white. Ovary inferior, oblong-ovoid, green, papillose, 3-celled, with numerous axile ovules in two rows in each cell; style $2\frac{1}{4}$ inches long, horizontally flattened, subpetaloid, scarlet, erect in the posterior part of the flower; stigma terminal, truncate, linear. Fruit, a roundish capsule about $\frac{1}{2}$ inch long, crowned with the withered remains of the flower, pericarp thin, membranous, greyish-brown, muricated with deciduous filiform processes, dehiscing loculicidally into 3 valves. Seeds several, nearly globular, dark brown; testa thin, marked with minute distant punctuations; embryo club-shaped, the narrower radicle at the hilum in contact with the testa and covered for a short way down with a sheath prolonged from the inner seed-coat.

Habitat.—*C. edulis* is cultivated in Peru, where it was originally observed by Ruiz and Pavon; it was first grown in England in 1823 from seed collected by them 30 years before. It is also supposed to be the species cultivated in the West Indian Islands (especially St. Kitts) for the starch of its rhizomes, but this has not been made out with certainty.

The species of *Canna* have been as yet little studied, and their limits are ill-defined; they are also said to vary much under cultivation. The plant figured and above described has been grown at Chelsea Gardens under the above name for many years, but it cannot be said to agree well with the authentic specimens of *C. edulis* in the Lambertian herbarium (now in the British Museum). These have smaller (and paler?) flowers and narrower staminodes, the bracts are much larger, and the habit of the plant more slender. We have not, however, been able to refer the Chelsea Gardens plant with more certainty to any other described species, though *C. Lamberti* Lindl. (figured in Bot. Reg. t. 470, and Roscoe's 2nd plate) appears to have several characters in common with it.

Ruiz & Pavon, Fl. Peruviana, i, p. 1; Roscoe, Scitamineæ;

Botanical Register, vii, Appendix; Grisebach, Fl. Brit. W. Indies, p. 603; Lindl., Fl. Med., p. 570.

Official Part and Name.—Canna; the fecula prepared from the rhizome of an undetermined species of Canna (U. S. P.). It is not official in either the British Pharmacopœia, or the Pharmacopœia of India.

This starch is commonly known under the name of Tous les Mois. It is principally imported from St. Kitts, but nothing is known of its botanical source, except that it is derived from one or more species of Canna.

Extraction.—In order to extract the starch, the rhizomes or tubers are first rasped by means of a machine into a pulp; and from this pulp the starch is obtained by washing, straining, decantation of the supernatant liquor, and desiccation of the deposited starch.

General Characters and Composition.—*Canna starch* or *Tous les Mois,* as seen by the naked eye, is a white powder, having a peculiar satiny or glistening appearance on account of the large size of its constituent granules. The sparkling or glistening appearance of the granules is very obvious when viewed by a magnifying lens. When examined by the compound microscope the granules are seen to be very large, exceeding in this respect all other known starches, being from the 200th to the 300th of an inch in length. They have a somewhat flattened appearance, and an ovate or oblong form; the hilum, which is not very conspicuous, is at one end of the granule, and is encircled with numerous, regular, distinct, unequally distant rings.

Tous les Mois has the same composition as that of other starches.

Medical Properties and Uses.—Tous les Mois has all the properties of starch, and is nutritious and demulcent. It may be used as a demulcent in urinary and bowel complaints. It affords, when boiled with twenty times its weight of water, a more tenacious jelly than that of West Indian Arrow-root or Maranta Starch, and is well adapted to form a wholesome and nutritious food for infants,

convalescents, and invalids. It is, however, but little used in this country, or elsewhere.

Per. Mat. Med., by B. & R., p. 450; Pharmacographia, p. 573; U. S. Disp., by W. & B., p. 208.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Garden of the Apothecaries' Company, Chelsea, in flower in September.

1. Inflorescence.
2. Vertical section of flower.
3. Transverse section of ovary.
4. Ripe fruit.
5. Seed.
6. Section of the same.
7. Embryo.
8. Diagram of flower.
9. Rhizome.

(3 enlarged.)

D. Blair ad. sicc. del. et lith.

M&N Hanhart

ELETTARIA CARDAMOMUM, *Maton.*

N. Ord. ZINGIBERACEÆ. Lindl., Veg. Kingd., p. 165; Le Maout and Dec., p. 760.

Genus Elettaria,* *Maton.* Endlicher, Gen. Plant., p. 223. Species about 8, natives of tropical Asia.

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267. Elettaria Cardamomum,† *Maton in Trans. Linn. Soc.*, x, *p.* 254 (1811).

Malabar Cardamom. Cardamom. Ailum (Malabar).

Syn.—Amomum repens, *Sonnerat.* A. Cardamomum, *White*, non *Linn.* Alpinia Cardamomum, *Roxb.* Matonia Cardamomum, *Smith.*

Figures.—Woodville, t. 231; Trans. Linn. Soc., x, t. 4, 5, cop. in Steph. and Ch., t. 106; Nees, t. 64; Berg & Sch., t. 34 c; Rheede, Hort. Malabar, xi, tt. 4, 5; Roxb., Pl. Coromandel, iii, t. 226.

Description.—A large perennial herb, with a thick fleshy or woody rhizome giving off fibrous roots below and ringed with the scars of the attachment of previous leaves, branched and sending up flowering stems 6—12 feet in height, which are erect, smooth, gradually tapering, shining and covered with the leaf-sheaths. Leaves large, alternate and distichously arranged, sheathing, sheaths very long, half surrounding the stem and overlapped by those below, terminating above in a short rounded ligule, blade spreading 1—2½ feet long, convolute in vernation, lanceolate or narrowly lanceolate, very acute at the apex, tapering at the base into a very short footstalk, quite entire, firm, smooth and dark green above, pale glaucous-green and finely silky beneath, midrib strong, very prominent beneath, lateral veins very numerous, parallel, coming off at an acute angle. Flowering-stems given off from the upper part of the rhizome-branches and spreading horizontally near the ground, from a few inches to 2 feet long, jointed, flexuous, with numerous large distichous blunt oblong bracts at the nodes, persistent, dry, and withered in fruit. Flowers rather small,

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* *Elettari* is the native name of the plant in Malabar.

† *Cardamomum*, καρδάμωμον; the name of some Indian spice in classical times.

stalked, laxly arranged about 4 together in small racemes coming from the axils of the large bracts; a similar bract of smaller size stands opposite the base of each pedicel. Calyx superior, tubular, narrowly oblong, very delicate and transparent, cut into 3 short triangular teeth at the apex. Corolla with a slender delicate tube extending considerably beyond the calyx, divided above into 3 nearly equal, oblong, obtuse, concave membranous pale green segments, the anterior one rather the larger. Andrœcium of 6 portions in 2 rows; the outer row consisting of 3 unequal staminodes inserted at the mouth of the corolla tube, two being small, horizontal, horn-like, somewhat twisted opposite bodies, and the third large, petaloid (the labellum), rhomboidal-spathulate from a narrow base, obscurely 3-lobed and with the margin undulated, white, with pink or purple veins; the inner row also of 3 unequal parts, two being small, barren, acicular staminodes inserted on the top of the ovary (epigynous), and the third a fertile stamen inserted at the mouth of the corolla between the horn-like staminodes of the outer row; filament rather short, connective thick and fleshy, anther 2-celled, adnate, introrse, the cells contiguous but separated by the style which passes up between them. Ovary inferior, smooth, ovoid, 3-celled, style very slender and thread-like, thickened above, stigma capitate, small, hairy, occupying the space between the summits of the two anther-cells. Fruit oblong-ovoid, $\frac{1}{2}$—$\frac{3}{4}$ inch long, bluntly triangular, smooth, striate, pale yellowish-grey, pointed, tipped with the withered perianth, pericarp thin, dehiscing loculicidally into 3 valves. Seeds several in each cell, closely packed, angular, obtusely wedge-shaped, dark brown, slightly rough or wrinkled, with a small hilum, attached by their sharp angle to the axis, embryo straight, axile, small, with the radicle towards the hilum and projecting beyond the farinaceous endosperm, from which it is also separated by an investment of fleshy substance (the vitellus).

Habitat.—A native of Southern India, growing abundantly in rich humid forests at an elevation of 2500—5000 feet above the sea in the hills of North Canara, Coorg and Wynaad. It is cultivated in the same districts. The flowers are produced in

April and May, and the fruit ripens in October and November. A variety occurs wild in Ceylon (*E. major,* Sm.) with a larger and more elongated capsule. The plant has been introduced into Java. In England the plant is grown at the Kew and Regent's Park gardens, but it does not flower here.

There appears to be considerable variety in the form of the corolla; the colour of the labellum is also differently described by Roxburgh, White and Berg.

Roxb., Fl. Indica, i, p. 70; White, in Trans. Linn. Soc., x, p. 229; Maton, ib., p. 249; Blume, Enum. Pl. Javæ, i, p. 51; Lindl., Fl. Medica, p. 565; Flück. & Hanb., Pharmacogr., p. 582 Roxburgh, Cor. Plants, iii, p. 19.

Official Parts and Name.—CARDAMOMUM; the dried seeds of the Malabar Cardamom (B. P.). The dried capsules (I. P.). CARDAMOMUM; the fruit (U. S. P.).

Cultivation, Production, and Preparation.—Cardamoms are the produce of Southern India, where the plant, which is commonly called *Ilachi,* grows wild in the forests; but the fruits are also largely obtained from cultivated plants. The authors of Pharmacographia have described the mode of cultivation as pursued in the forests of Travancore, Coorg, and Wynaad; also on the lower range of the Pulney Hills, near Dindigul, and in Northern Canara and Western Mysore, for particulars of which we must refer our readers to that volume. The gathering of the fruits commences in October, and continues during dry weather for two or three months. The fruits are dried in different ways, thus, in some cases the whole scape of fruits is gathered at once and dried, although all the fruits are not ripe at the same time; or the fruits as they are collected, are carried to the houses, and partially dried "for a few days on mats, they are then stripped from their scapes, and the drying completed by a gentle fire-heat. In Coorg the fruit is stripped from the scape before drying, and the drying is sometimes effected wholly by sun-heat." The seeds are best kept in their pericarps, in which condition they are imported, but when required for medicinal use the seeds should be separated from them, and the pericarps rejected.

General Characters, Varieties, Commerce, and Composition.—The fruit of commerce is ovoid or oblong in form, 3-sided, and 3-celled; each cell contains from 5 to 7 seeds, which are arranged in two rows. Its base is rounded, and has frequently the remains of a stalk; and its apex terminates in a short beak-like process. The pericarp is yellowish-grey or brownish-yellow in colour, longitudinally striated, of a papery, and somewhat coriaceous texture, and without taste or odour. Two varieties of Malabar Cardamoms are distinguished in commerce from characters afforded by their fruits, as *shorts* and *short-longs*. Pereira notices a third variety under the name of *long-longs*, but this kind is now but very rarely or ever imported. The *shorts* are plump, heavy, ovoid, or somewhat rounded in form, from about $\frac{4}{10}$ to $\frac{6}{10}$ of an inch in length, and from $\frac{2}{10}$ to $\frac{4}{10}$ of an inch in breadth. The *short-longs* are more tapering at each end, from about $\frac{7}{10}$ to nearly an inch long, and about the same breadth as the shorts. They are distinguished from the shorts not only by their greater length and more tapering character, but also by being of a paler colour, and more finely ribbed.

Cardamoms are also further known in commerce by the districts from whence derived, as *Malabar*, *Madras*, and *Aleppy*. The *Malabar Cardamoms*, which are commonly brought to Europe by way of Bombay, are of the highest commercial value, being plump, heavy, and of dark colour. They are found in the two forms of *shorts* and *short-longs*. The *Madras Cardamoms*, which are paler coloured and usually in the form of *short-longs*, are exported from Madras and Pondicherry; and those known as *Aleppy Cardamoms* are shipped from Calicut or Aleppy, and are usually *shorts*. The value of cardamoms is estimated by their plumpness, heaviness, and by the soundness and ripeness of their seeds. These conditions are generally most evident in the *shorts* of each commercial variety. One hundred parts of the fruit yield on an average seventy-four parts of seeds, and twenty-six of pericarp, that is, the seeds constitute about three fourths of their weight.

The *seeds*, which are *alone official*, are about $\frac{1}{5}$ of an inch

long, irregularly angular, transversely wrinkled, dark brownish-red externally, and whitish internally. They have an agreeably warm, aromatic taste and odour.

Cardamoms owe their properties essentially to the presence of a *volatile oil* of which good shorts yield about 4·6 per cent. This volatile oil has the odour and flavour of the seeds in a concentrated degree. Its sp. gr. is about 0·93; it is colourless when fresh, but by keeping it becomes yellow, thicker, and loses in a great measure its peculiar taste and smell. It is said to consist of a liquid volatile oil, and a crystalline camphor identical with turpentine camphor. It is strongly dextrogyre.

Medical Properties and Uses.—The effects of cardamoms are those of a very agreeable aromatic; they are used partly on account of their flavour, and partly for their carminative and stimulant properties. They are, however, rarely prescribed alone, but commonly either as adjuvants or correctives of cordial, tonic, and purgative medicines. In Great Britain and in the United States, cardamoms are but little used, being only employed in medicine, and to a very limited extent as an ingredient in the preparation of the condiment known as curry powder. But in the East Indies, besides their medicinal use, they are largely consumed as a condiment and for chewing with betel, as described by us under 'Areca Catechu.' In Russia, Norway, Sweden, and parts of Germany, cardamoms are also much in demand for flavouring cakes and in the preparation of liqueurs, &c.

Other Kinds of Cardamom.—Besides the *Malabar* or *Official Cardamoms* above described, a number of other zingiberaceous fruits have been, or are now, employed in pharmacy, and for other purposes, under the common name of *Cardamoms*. For a description of these we must, however, refer to special works on Materia Medica, and more particularly to Pereira's 'Materia Medica' and Flückiger and Hanbury's 'Pharmacographia.'

Per. Mat. Med., vol. ii, pt. 1, p. 258; Per. Mat. Med., by B. & R., p. 457; Pharmacographia, p. 583; Elliot, Experience of a Planter in the Jungles of Mysore, London, vol. ii (1871), pp. 201 & 209; U. S. Disp., by W. & B., p. 226; Amer.

Journ. Pharm., vol. xxi, p. 116; Pharm. Journ., ser. 3, vol. iii, p. 208; Amer. Journ. Pharm. (1873), p. 389.

DESCRIPTION OF PLATE.

Drawn from a specimen in the herbarium of the late D. Hanbury, collected in India by Wight.

1. Portion of a flowering branch.
2. A flower.
3. Vertical section of base of flower showing the two acicular staminodes.
4, 5, 6. Side, front, and back view of anther and style.
7. Transverse section of ovary.
8. Base of stem with a fruit-bearing branch.
9. Transverse section of fruit.
10, 11. Seeds.
12. Section of the same.
13. A leaf.

(2–7, 9, 11, 12 enlarged.)

D.Blair F.L.S. ad sicc. del. et lith.

M&N.Hanhart imp

AMOMUM MELEGUETA, *Roscoe.*

N. Ord. ZINGIBERACEÆ.

Genus **Amomum**,* *Linn.* Endlicher, Gen. Plant., p. 223. A genus of over 30 species, natives of tropical countries in the Old World.

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268. Amomum Melegueta,† *Roscoe, Monandrian Plants*, no. 98 (1828).

Syn.—A. Granum-Paradisi, *Afzelius ?* non *Smith.*

Figures.—Nees, t. 65 (excl. flowers) (*A. Granum-Paradisi*); Roscoe, Monandrian Plants, 98th plate, copied (fls.) in Berg, Characterist., t. xiii, fig. 137; Pereira, Mat. Med., ii, p. 246 (fruit).

Description.—A herbaceous perennial, with a long, slender, twisted, branched, horizontal rhizome, surrounded with numerous, large, loose, persistent, blunt sheathing bracts. Leaf-bearing barren stems 3—6 feet high, erect, straight, slender, completely enclosed in the very long leaf-sheaths. Leaves large, alternate, distichous, sheathing, sheaths split throughout. very long, close, striate, quite smooth, rounded at the top, and terminating in a short rounded ligule; blade (wanting in the lower leaves) 6—9 inches long, lanceolate-oblong, attenuated at the apex, narrow at the base, entire, convolute in vernation, midrib narrow and prominent, lateral veins very fine. Flowers very large, solitary, on very short peduncles, coming off directly from the rhizome and covered with strongly imbricated brownish bracts becoming larger upwards. Calyx superior, split down one side and spathe-like, membranous, pale-green, veined. Corolla large, delicate, white or pale pink or purplish, with a funnel-shaped tube, which exceeds the calyx, and three unequal, deeply-cut lobes, the posterior one much the largest, erect,

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* *Amomum*, ἄμωμον, the classical name of some undetermined Eastern spice-bearing plant.

† *Melegueta* or *Malaguetta* is said by Hanbury to be the *African* name of the seeds, but it is more probably of Spanish origin. It was in use for them in Europe in the middle ages, and Bauhin (Pinax, p. 314) derives it from *Melica* (now *Sorghum*), from the resemblance of the seeds to that grain. The fruits of *Xylopia æthiopica*, A. Rich., of Senegal, have also been called "Melegueta Pepper." In modern Spanish the word *Malagueta* is applied to various small pungent spices.

concave, almost helmet-shaped, broad and blunt, the two lateral spreading, much shorter, linear. Androœcium of 6 portions; the outer row of 3 very unequal staminodes inserted at the mouth of the corolla-tube, of which two are very small and subulate, and the other, the labellum, petaloid, very large, about 2 inches long, broadly obovate, narrow at the base, much undulate-plicate at the margins, very delicately veined, very pale pink or purplish, with a darker border and yellowish at the base; the inner row also of 3 very unequal portions, of which two are narrow, oblong, yellow, erect, epigynous bodies, and the third the fertile stamen; this latter is inserted at the mouth of the corolla-tube between the two subulate staminodes of the outer row, erect; filament flat, wider above, and beyond the anther expanding into broad, flat, red appendage, $\frac{1}{2}$ inch wide, with a spreading tooth on either side and a bifid central portion; anther 2-celled, the cells adnate, oblong, separated by the style. Ovary inferior, 3-celled. Style slender, about two inches long, smooth, stigma thickened, flat on the top, occupying the space between the upper ends of the anther-cells. Fruit ovate-oblong, cylindrical, about 3 inches long, smooth, orange or red, surrounded at the base by sheathing bracts and crowned by the remains of the calyx and corolla, pericarp thick, fleshy, indehiscent, imperfectly 3-celled, with the numerous seeds loosely attached or imbedded in a colourless pulp. Seeds about $\frac{1}{8}$ inch in diameter, rather variable in shape, usually somewhat wedge-shaped, pointed at the hilum, rounded or flat on the back, more or less angular, with flattened sides, covered with a thin bright brown aril (?) much paler at the hilar end; testa rather thick, hard, black, granulated, embryo oblong, straight, axile, the radicle exserted, surrounded by the vitellus, which separates it from the hard, radiate, snow-white, farinaceous endosperm.

Habitat.—This beautiful plant is a native of the coast regions of West Tropical Africa, extending from Sierra Leone southwards to the Congo, through Liberia and the Gold Coast, and of Princes and St. Thomas' Islands in the Gulf of Guinea. The "Grain Coast" or "Pepper Coast" itself lies to the immediate east of Liberia, between it and Cape Palmas. The Melegueta Pepper has

been carried to other tropical countries, and is grown in Guaiana (Demarara), whence the seeds came which furnished the plant figured and described by Roscoe. It is readily cultivated in our hothouses, and even ripens fruit in this country.

A small narrow-leaved variety occurs at Sierra Leone; and the plant varies much in height, colour of flowers, size of fruit, and other points in different localities.

The name *Amomum Granum-Paradisi*, Linn., has been abandoned by many authors. Linnæus's species was probably a combination. Under the same name, Afzelius in 1815 gave a full description of the plant affording Grains of Paradise in Sierra Leone, and *A. Granum-Paradisi*, Afz., is perhaps the name that should be adopted. Smith, however, has referred this name to a species (also collected by Afzelius) which is not *A. Melegueta*, and he has been followed by others; amid so much confusion, the name is better dropped, and Roscoe's one, about which there is no doubt, adopted.

The plate in Nees, t. 65, under the name *A. Granum-Paradisi*, is probably our plant, the flowers, however, are copied from the figure of *A. exscapum*, Sims, in the Annals of Botany, vol. i, t. 13.

Afzelius, Remedia Guineensia, p. 71 (1815); Smith, in Rees' Cyclopædia; Roscoe, loc. cit.; Hook. fil., in Hook. Journ. Bot., vi, p. 293; Lindl., Fl. Med., p. 565; Flück. & Hanb., Pharmacogr., p. 590.

Part Used and Names.—Grana Paradisi; the seeds. They are not official in the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States. But they were formerly official in the pharmacopœias of this country. These seeds are commonly known under the names of *Grains of Paradise*, *Guinea Grains*, and *Melegueta Pepper*.

Commerce.—Grains of Paradise are almost entirely exported from that part of the coast of Guinea in Western Africa, which is known as the Gold Coast, and principally from the stations of Cape Coast Castle and Accra. The exports average nearly 2000 cwt. annually, nearly half coming to Great Britain.

General Characters and Composition.—*Grains of Paradise*, as seen in commerce, are about $\frac{1}{10}$ of an inch in diameter, roundish, ovoid,

or somewhat wedge-shaped, in form, and bluntly angular. They have a hard texture, a shining golden-brown or reddish-brown colour, and are marked with a somewhat beak-shaped hilum of paler colour than the rest of the seed. Their surface is rough from the presence of small granulations and wrinkles; and internally they are white. When crushed and rubbed between the fingers, their odour is feebly aromatic; and their taste is somewhat aromatic, and very pungent and burning. The pungent taste resides in the integuments.

The principal constituents of grains of paradise are *volatile oil, resin,* and *starch;* and their properties are due to the resin and volatile oil, which are essentially contained in the seed-coats. The proportion of volatile oil, according to the authors of Pharmacographia, is only about 0·30 per cent., 53 lbs. yielding but $2\frac{1}{2}$ fluid ounces. It has a yellowish colour, an aromatic odour resembling the seeds, and an aromatic taste. Its specific gravity is 0·825 at 60°, and it boils at 456°. From its optical behaviour it is supposed by Flückiger and Hanbury, to be homogeneous. The pungency of grains of paradise depends upon the resin.

Properties and Uses.—Their properties are analogous to those of pepper. They were formerly regarded in this country as very injurious, but this idea is quite erroneous; and in Africa they are esteemed as the most wholesome of spices, and generally used by the natives to season their food. Their principal consumption in Great Britain and the United States is in the preparation of cattle medicines, and to give pungency to cordials, and also for communicating an artificial strength to spirits, wine, beer, and vinegar. The spiced wine called *hippocras,* in use during the 14th and 15th centuries, was flavoured with grains of paradise, cinnamon, and ginger.

Per. Mat. Med., vol. ii, pt. 1, p. 244; Pharmacographia, p. 590; Daniell, in Pharm. Journ., vol. xiv, ser. 1, pp. 312 & 356; Pereira, in Pharm. Journ., vol. ii, ser. 1, p. 443; Sandrock, Archiv der Pharm., Jan., 1853, p. 18.

DESCRIPTION OF PLATE.

Drawn from a specimen in the herbarium of the late D. Hanbury, cultivated by him at Clapham, the fruit added from a specimen in spirit in the British Museum.

1. Portion of rhizome with a flower.
2. Pistil with part of the corolla-tube showing all the staminodes except the labellum.
3. Part of the corolla, with the antheriferous staminode *in situ*.
4. A fruit.
5. Transverse section of the same.
6, 7. Seeds.
8. Vertical section of the same.
9. A leaf,

(7, 8 enlarged.)

D.Blair, ad nat. del. et lith.

M& N.Hanhart imp.

CURCUMA LONGA, *Linn.*

N. Ord. ZINGIBERACEÆ.

Genus Curcuma,* *Linn.* Endlicher, Gen. Plant, p. 223. Species about 25, natives of the tropical East Indies.

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269. Curcuma longa, *Linn., Sp. Plant., ed.* 1, *p.* 2 (1753).

Turmeric.

Syn.—Amomum Curcuma, *Jacq.* Curcuma rotunda, *Linn.*

Figures.—Woodville, t. 252; Rheede, Hort. Malab., xi, t. 11; Jacq., Hort. Vindob., iii, t. 4; Bot. Register, xi, t. 886.

Description.—A perennial herb with a permanent, irregularly rounded or ovate root-stock, which gives off lateral, elongated, cylindrical branches, wrinkled externally, often swelling into fusiform tubercles and emitting numerous roots, when mature brownish externally, deep yellow or orange on section. Leaves all radical, convolute in vernation, when full grown over three feet long, including the long, rather slender petioles which sheath at the base, obovate-lanceolate or -oval, very acute at the apex, gradually attenuated into the petiole, entire, smooth, thin, bright uniform green; midrib very strong and prominent beneath; the lateral nerves slender, close, nearly straight, coming off the midrib at a very acute angle. Flowering stems from the centre of the tuft of leaves, and appearing before the latter are full grown, about a foot high including the inflorescence which occupies about half its length, cylindrical, stout, solid, pale green, with a few pale sheathing bracts, the upper one larger and somewhat leafy. Flowers sessile, usually in pairs, in the axils of large, concave, spreading bracts, and exceeding them, imbricated in a rather dense spike; the lower bracts ovate, blunt, saccate at the base, pale green, sometimes tinged with purplish red; the upper ones empty, forming a terminal tuft (coma), narrower, undulated, white tinged with bright pink (brighter before the inflorescence

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* *Curcuma* is said to be "from the Persian *Kurkum*, a name applied also to Saffron."

has expanded), each flower provided with 2 small, ovate, scaly bracts at the base. Calyx superior, very short, funnel-shaped, bluntly 3-lobed, membranous, gamosepalous, yellowish. Corolla gamopetalous, consisting of an infundibuliform tube more than twice the length of the calyx, and three ovate-lanceolate, acute, erect, rigid, orange-coloured segments, about as long as the tube, the posterior slightly hooded, rather larger than the two lateral ones, which are approximated in front. Androecium of 6 portions in two rows; the three outer petaloid, bright yellow (often described as an inner series of corolla-segments) arising from the summit of the tube of the corolla, the two lateral equal, obovate-oblong, bifid or lobed at the end, overlapping the anterior one, which forms the lip of the flower, and is rounded, deeply bifid, and spreading; the three inner not petaloid, the two lateral reduced to two small filiform staminodes inserted at the very base of the corolla-tube, the posterior one antheriferous, with a broad filament inserted on the corolla-tube between the two lateral staminodes of the outer row and opposite and at the base of the posterior corolla-segment. Anther distinctly two-celled, oblong, tailed at the base, minutely hairy outside, introrse, connective prolonged into a short beak curved over above the anther. Ovary inferior, globose, 3-celled, with numerous ovules in several rows; style very long, slender, the upper part passing between the lobes of the anther and concealed by them; stigma capitate, standing immediately above the anther and beneath the process of the connective. Fruit not seen: of the genus, a dry 3-celled capsule, loculicidally 3-valved, with numerous seeds; the seeds roundish, with a short arillus and a small straight embryo, with the radicle exserted beyond the radiated endosperm.

Habitat.—This handsome plant is cultivated extensively about Calcutta and throughout Bengal; also in Ceylon, many of the East Indian Islands, and the Fijis. We have seen a specimen from the Cape of Good Hope. Its native country is probably some part of the Indian peninsula, but cannot now be determined. It was introduced into our stoves so long back as 1759 by P. Miller, and may be seen in most botanic gardens; it flowers

in the early summer. We have not met with any account of the fruit.

Many species of this fine genus are figured in Roscoe's great work on the *Scitamineæ*, but the present is not included in it. *C. aromatica*, Salisb. (*C. Zedoaria*, Roxb. non Rosc.), is the subject of an excellent plate in Berg & Schmidt, t. 34 a.

Retzius, Observ. Bot., fasc. iii, p. 72 (1783); Roxb., Fl. Indica, i, p. 32; Seemann, Fl. Vitiensis, p. 291.

Official Part and Names.—TURMERIC; the rhizome (B. P. *Appendix*). The Root-stock or Tubers (*Curcuma, Turmeric*) (I. P.). CURCUMA; the rhizome (U. S. P. *Secondary*).

General Characters, Varieties, and Composition.—There are two sorts of turmeric seen in commerce—the *round* and the *long*, but both are the produce of the same plant; the central rhizomes or root-stocks constituting the round, and the lateral or secondary rhizomes (*tubers*) the long; the latter are the more abundant. The *former* are roundish or somewhat ovate, usually from about one inch and a half to two inches in length, and one inch in diameter, pointed at one end, and marked externally with annular ridges. They are often found cut into halves. The *latter* are somewhat cylindrical, more or less curved, pointed at the two extremities, frequently having on their sides one or more short knobs or shoots, about the thickness of the little finger, two or three inches long, and marked externally with annular ridges. Both sorts are yellowish externally, very hard and firm, and when broken having a waxy-resinous appearance, and an orange-yellow or reddish-brown colour. The powder is orange yellow. Turmeric has an aromatic taste and odour somewhat resembling ginger, but peculiar. When chewed it tinges the saliva yellow.

There are several varieties of turmeric known in commerce, as China, Bengal, Madras, Bombay, Java, and Cochin. The latter variety is the produce, however, of another species of *Curcuma*. The China kind is the most esteemed, but is rarely met with in Europe. The Java is of low commercial value. A rhizome called "African Turmeric" has also been described by Dr. Daniell,

which resembles in appearance and properties the other kinds of commercial turmeric. It is said to be the produce of *Canna speciosa* of Roscoe, but this requires further investigation.

Turmeric contains about one per cent. of a *volatile oil* to which its odour is due, some *starch*, a yellow colouring matter called *curcumin*, and other unimportant substances. The alkalies change the colour of curcumin to reddish brown; and boracic acid produces an orange tint; hence paper tinged with tincture of turmeric is largely employed as a test of the presence of alkalies.

Properties and Uses.—Turmeric is not now used as a remedial agent; but is introduced into the pharmacopœias as a test of the presence of alkalies, its action on which has just been noticed. For this purpose the British Pharmacopœia directs unsized white paper to be steeped in tincture of turmeric, and dried by exposure to the air.

Turmeric is also employed as a condiment, and is a constituent of the well-known Curry Powder, and of many other articles of Indian cookery.

Turmeric is likewise used for dyeing wool, silk, &c., but the colour, though a fine yellow, is not durable. It is also occasionally employed in pharmacy in colouring ointments and other preparations.

Curcuma Starch. East Indian Arrowroot.—The starch known under the names of *Curcuma Starch*, *Tikor*, and *East Indian Arrowroot*, and which is a favorite article of diet among the natives in some parts of India, is obtained from the colourless rhizomes of certain species of *Curcuma*, but principally of those of *C. angustifolia*, Roxb., and *C. leucorrhiza*, Roxb. Its properties are similar to those of West Indian Arrowroot or Maranta starch. It is sometimes met with in this country, but the starch commonly sold here as East Indian Arrowroot is Maranta starch.

Per. Mat. Med., vol. ii, pt. i, pp. 237 and 240; Pharmacographia, pp. 574 and 578; U. S. Disp., by W. and B., p. 357; Journ. Chem. Soc., vol. xi (1873), p. 504; Drury, Useful Plants of India, 1873, 2 edit., p. 168; Pharm. Journ., vol. i, 2nd ser., p. 258.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Royal Gardens, Kew.

1. Base of a young plant showing early condition of the rhizome-branches.
2. Flowering stem with spike of flowers.
3. Upper part of leaf before expansion.
4. Vertical section of flower to show fertile stamen and two lateral petaloid staminodes.

5, 6, 7. Front, side, and back view of anther.

8. Transverse section of ovary.
9. Vertical section of the same, also showing the two filiform staminodes.

(5–9 enlarged.)

D.Blair F.L.S. ad nat del et lith.

M & N. Hanhart

ZINGIBER OFFICINALE, *Roscoe.*

N. Ord. ZINGIBERACEÆ.

Genus Zingiber,* *Gaertn.* Endlicher, Gen. Plant., p. 222.
Species about 20, natives of Tropical Asia.

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270. Zingiber officinale, *Roscoe, in Trans. Linn. Soc.*, viii, *p.* 348 (1807).

Ginger.

Syn.—Amomum Zingiber, *Linn.*

Figures.—Woodville, t. 250; Steph. & Ch., t. 96; Jacquin, Hort. Bot. Vindob., i, t. 75, cop. in Nees, t. 61; Berg. & Sch., t. 34 b; Rumph., Herb. Amboin., v, t. 66; Roscoe, Monandrian Plants, 83rd plate.

Description.—A perennial herb, with a large, solid, tough, horizontal rhizome, consisting of a series of many persistent roundish joints, pale yellow within, covered with pale silvery-brown skin, ringed with leaf-scars, and each marked at the summit by a large, circular, flat scar, much branched, the new joints coming off below the terminal scars; roots numerous, large, cylindrical, fleshy, thick, brittle, semitransparent, yellow. Barren leafly stems erect, 3 or 4 feet high, entirely covered by the leaf-sheaths. Leaves alternate, distichous, sheaths long, lax, standing away from the stem, terminating in two small, rounded auricles, smooth, pale green; blade absent or nearly so in the lower leaves, in the upper about 8—12 inches long, spreading, lanceolate-linear, tapering at both ends often much so at the apex, very shortly petiolate, smooth, bright green, paler and with a prominent midrib beneath. Flowering-stems shorter than the leafy ones, 6—12 inches high, erect, slender, surrounded with a few loose, blunt leaf-sheaths the upper ones sometimes with a short blade; flowers few, rather small, sessile, soon withering, each surrounded by a smooth, thin, convolute bract, and placed in the axils of large, concave, smooth, striate, greenish-yellow obtuse bracts with membraneous margins, which are closely

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* *Zingiber*, in Greek Ζιγγίβερι, the classical name for the spice, derived from the Sanscrit.

placed at the summit of the flowering stem, strongly imbricated, and collectively form an ovate-oblong, blunt, dense, cone-like terminal spike, about 2 or 3 inches long. Calyx tubular, split half way down one side, membranous, superior. Corolla orange-yellow, speckled, the tube much exceeding the calyx, divided above into three nearly equal, spreading or reflexed, linear-oblong, blunt segments, the posterior one rather the largest. Staminodes 6, in two rows, the outer row of 3 inserted at the mouth of the corolla, the posterior 2 small and horn-like, the anterior (labellum) petaloid, rather shorter than the corolla-lobes, purple with paler spots, divided into 3 blunt, rounded lobes, the central one much the largest; the inner row of staminodes represented by 2 elongated filiform bodies on the top of the ovary, and a fertile stamen inserted at the mouth of the corolla, filament very short, connective prolonged above the anther into an entire horn-like process wrapped round the end of the style, anther-cells in contact, oblong-linear. Ovary inferior, 3-celled, with numerous ovules; style passing up behind and between the anther-cells and extending beyond them; stigma tufted; fruit not seen.

Habitat.—The ginger is not known in a truly wild state, but only in cultivation or escaped from it. It is, however, without doubt, a native of tropical Asia, whence the root has been exported to Europe from very early times. From Asia the plant was carried to the West Indies, and at the present day is abundant there, and is indeed cultivated in all the warmer regions of both Worlds. It appears to flower but rarely, and we have not met with specimens or descriptions of the fruit and seeds. It has been grown as a curiosity in England since the beginning of the 17th century, and is common in botanic gardens, but it does not flower.

Roxburgh, Fl. Indica, i, p. 47; Grisebach, Fl. Brit. W. Indies, p. 602; Roscoe, Monandrian Plants, l. c.; Lindl., Fl. Medica, p. 659.

Official Part and Names.—ZINGIBER; the scraped and dried rhizome (B. P.). ZINGIBERIS RADIX; the dried decorticated rhizome (I. P.). ZINGIBER; the rhizome (U. S. P.).

Preparation.—The dried rhizomes, called *ginger*, are known in two forms, which are respectively termed *uncoated* or *scraped ginger*, and *coated* or *unscraped ginger*; the latter is alone official in the British Pharmacopœia and in the Pharmacopœia of India. For the preparation of the *uncoated* or *scraped ginger* the rhizomes are dug up when about a year old; they are then washed and scraped so as to remove their cortical integument or skin, and are afterwards dried in the sun. This kind of ginger has been sometimes termed *white ginger*. The *coated* or *unscraped ginger* is prepared in a similar manner, except that the rhizomes are not scraped, hence they are covered by a dry, wrinkled, or shrivelled integument. This kind is sometimes called *black ginger*.

General Characters, Varieties, and Commerce.—*Uncoated* or *scraped ginger* occurs in flattish irregularly-branched pieces, which are called by the spice dealers *races* or *hands*, from their presenting a somewhat palmate form. Each branch is marked by a depression at its summit, which indicates the former attachment of a leafy stem. The pieces vary in length, but are commonly from about three to four inches. The external surface presents a pale buff colour, and is somewhat fibrous and striated. They break readily with a short mealy fracture, and the fractured surfaces present numerous projecting bristle-like fibres. When cut the younger terminal portion of the rhizome is found to be soft, pale yellow, bright and mealy; while the older portion is flinty, darker coloured, and resinous. This kind of ginger, especially when of inferior quality and dark coloured, is often bleached, either by immersion for a short time in a solution of chlorinated lime, or by exposure to the fumes of burning sulphur. Ginger thus treated acquires a chalky-white character, hence it is then sometimes termed *whitewashed* ginger. Indeed, sometimes, it is really washed in whiting and water under the pretence of preserving it from insects, in which case it is coated with carbonate of lime. In other instances, again, it is found coated with sulphate of lime. *Coated* or *unscraped ginger*, or that which has been dried without the removal of the skin,

is at once distinguished by being covered with a wrinkled, brown, somewhat striated integument. It is also generally of a darker colour and harder internally, and is regarded as inferior to uncoated ginger. Ginger has an agreeable aromatic odour, and a strong pungent taste. Its powder has a yellowish-white colour.

Several varieties of ginger have been distinguished by pharmacologists; those now commonly found in British commerce are *Jamaica, Cochin, Bengal,* and *African.* The African is a *coated* ginger; but the three others are *scraped* or *uncoated.* These several kinds vary in themselves very much in quality; but as a rule the Jamaica is most valued, and after it the Cochin kind. The best ginger is that which is in large fine pieces, uncoated, pale buff in colour, and which cut soft, bright, and pale coloured. At the present day ginger is chiefly imported into Great Britain from the East and West Indies, Sierra Leone, and Egypt.

Composition.—The principal constituents of ginger are *starch, volatile oil,* and *resin.* The odour of ginger is due to the volatile oil, and its pungent taste to the resin. The latter requires further investigation; but the former has been recently examined by Flückiger and Hanbury, who obtained it by distillation of Jamaica ginger with water in the usual way, in the proportion of about $\frac{1}{4}$ per cent. They describe it as a pale yellow liquid, of specific gravity 0·878, with the odour of ginger, dissolving but sparingly in spirit of wine, and levogyre.

Medical Properties and Uses.—Ginger possesses stimulant, aromatic, and carminative properties, when taken internally; and when chewed it acts as a sialagogue. Externally applied it is rubefacient. The stimulating, aromatic, and carminative properties render it of much value in atonic dyspepsia, especially if accompanied with much flatulence; and as an adjunct to purgative medicines to correct griping. When chewed it is frequently serviceable in relaxed conditions of the uvula and tonsils. As a rubefacient it will frequently relieve headache and toothache.

Ginger is also extensively used as a condiment. It is sometimes imported in a green state; and the preserved ginger of the shops is prepared by carefully picking the young rhizomes, or the

young shoots of the old rhizomes, and after these are washed and scraped, they are preserved in jars with syrup.

Per. Mat. Med., vol. ii, pt. 1, p. 231; Per. Mat. Med., by B. & R., p. 451; Pharmacographia, p. 574; U. S. Disp., by W. & B., p. 907; Trommsdorff, Annal. der Pharm., vol. xvii, p. 98; Garside, in Pharm. Journ., ser. 3, vol. iv, p. 831.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum from Madeira, the rhizome from a specimen cultivated in Kew Gardens.

1. A plant with barren and flowering stems.
2. A flower.
3. Vertical section of the same.
4. Fertile stamen.
5. Portion of leafy stem.

(2–4 enlarged.)

D.Blair F.L.S. ad sicc. del. et lith.

M&N.Hanhart imp.

ALPINIA OFFICINARUM, *Hance.*

N. Ord. ZINGIBERACEÆ.

Genus **Alpinia**,* *Linn.* Endlicher, Gen. Plant., p. 224. Species about 20?, natives of Tropical Asia, some introduced to other hot countries.

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271. Alpinia officinarum, *Hance, in Journ. Linn. Soc. Lond.* (*Bot.*) xiii, *p.* 6 (1871).

Lesser Galangal. Galangal.

Not previously figured.

Description.—A perennial herb with long, creeping, slender, smooth, cylindrical, reddish-brown rhizomes, about $\frac{1}{2}$—$\frac{3}{4}$ inch in diameter, covered with numerous large, paler scales, which after their fall leave irregular, white sinuous scars. Flowering stem 2—4 feet high, erect, covered by the leaf-sheaths. Leaves numerous, alternate, distichous, with long, smooth sheaths terminating above in an erect oblong, sub-acute, scarious ligule, an inch or more in length and decurrent at the base along the margin of the sheath; blade 9—14 inches long, narrowly lanceolate, narrowed at the base but not stalked, much attenuated at the apex, entire, very smooth and shining, leathery, bright green. Flowers of moderate size, nearly sessile, closely placed to form an erect, dense, terminal simple spike or raceme, 3 or 4 inches long, rachis very finely pubescent, bracts spathaceous, in pairs beneath each flower and longer than it, the outer green, the inner white, glabrous externally, scarious at the margins, often united at the top, deciduous, no bractlets. Calyx superior, tubular, finely pubescent, cut into 2 or 3 shallow, scarious, rounded, ciliate lobes. Corolla white, the tube about as long as the calyx, finely pubescent within and without, the lobes 3, oblong, obtuse, slightly hooded, the upper one rather the largest. Androœcium of 6 staminodes in two rows of 3; the outer row inserted at the mouth of the corolla, the two posterior small, subulate, stiff, fleshy, horn-like bodies, thickened and connivent at the base, so as to

* *Alpinia*, given by Plumier in honour of Prospero Alpino, an eminent Italian botanist, who died in 1617.

close the corolla-tube, the anterior (labellum) about ¾ inch long and nearly as wide, ovate, entire, acute or bilobed at the apex, crisped and denticulate at the margin, white, striated in the centre with dark-red veins, which coalesce into a distinct fan-shaped spot near the apex, whence paler veins radiate towards the margin; the inner row of two oblong, entire, truncate, yellow "glands" on the ovary, and of an antheriferous stamen, which is inserted at the mouth of the corolla and about half the length of the labellum, filament ribband-shaped curved into a sheath round the style, connective dilated but not produced beyond the anther, anther-cells linear-oblong, quite distinct and free, but in contact by their inner edge. Ovary inferior, densely tomentose, 3-celled, with numerous ovules, style filiform, in the sheath of the filament and passing between and behind the anther cells, stigma capitate, concave, with a ring of hairs round the margin. Fruit (not seen) very shortly stalked, ½ inch long, sub-globose, tomentose, finely striate, pericarp coriaceous, brown, containing numerous obtusely angled seeds which are coherent with each other, covered with a mucous aril, and with a shining dark brown testa.

Habitat.—This species was first met with in 1867, by Mr. Sampson, near the small village of Tung-sai, a little way from the coast at the southern extremity of the peninsula of Lei-chau-fu, in the extreme south of China and directly opposite Hoi-han, the port of the great island Haenan. In this locality, where it was again gathered in 1868 by Mr. Taintor, it appeared to be the remains of former cultivation, but Mr. Swinhoe afterwards observed it growing wild on the south coast of the island of Haenan itself. The specimens, living and dried, collected by these gentlemen formed the material of a careful investigation by Dr. Hance in 1870, which resulted in the definition of the new species *A. officinarum*, and the determination of it as the source of the "radix Galangæ minoris," of pharmacists; which had been so long unknown.

Dr. Hance considers this species very closely allied to *A. calcarata*, Rosc. (figured in Roscoe's 'Monandrian Plants,' 68th plate). He gives, however, several marks of distinction, one of

which is the complete absence of yellow in the labellum of *A. officinarum*.

The Greater Galangal root is obtained from *Alpinia Galanga*, Willd. (*Maranta Galanga*, Linn.), a native of Java.

Hance, in Journ. Linn. Soc. Lond., xiii, p. 1, and in Journ. Bot., 1873, p. 175.

Part Used and Name.—Galangæ Rhizoma; the rhizome. It is not official in the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States.

Varieties and Commerce.—Two varieties of galangal are known in commerce, namely, *radix Galangæ majoris*, the *greater* or *Java Galangal*; and *radix Galangæ minoris*, the *lesser* or *Chinese Galangal*. The larger Galangal, which appears to be the produce of *Alpinia Galanga*, Willd., a native of Java, may be occasionally seen at the London drug sales; but the latter is the one which is commonly used in Europe and elsewhere, and which is derived from the plant now under description. This galangal is shipped from Canton to other parts of China, and also to India and Europe; it is chiefly consumed in Russia and India.

General Characters and Composition.—Lesser galangal, the drug now under notice, consists of portions of the rhizomes, which vary from 1½ to 3 inches in length, and whose thickness rarely exceeds three quarters of an inch, and are commonly less. The pieces are cylindrical in form; often branched; and marked at short intervals by narrow, whitish, somewhat elevated rings, which are the scars left by former leaves or scales. Externally their colour is dark reddish-brown; internally they have a paler hue with a darker centre. The pieces are shrivelled, hard, and tough; their odour is agreeable and aromatic; and their taste strongly pungent and spicy.

The larger or Java Galangal may be readily known from Chinese Galangal by its much greater size, its feebler odour and taste, and its orange-brown colour externally.

Galangal contains a small quantity of *volatile oil*, that is, only from about ⅓ to ½ per cent, to which its odour is due. The other constituents which have been indicated by Morin, Vogel, and

Brandes, are an *acrid soft resin, extractive, gum, starch, fixed oil,* and a peculiar crystallizable substance called *kämpferid* by Brandes, its discoverer. This latter principle is said to be soluble in ether, and is described as neutral, inodorous, and tasteless. The pungent principle is probably the resin, but it requires further examination.

Medical Properties and Uses.—Galangal is an aromatic stimulant like ginger. It was formerly much employed by the Arabians and Greeks, and was used to some extent in this country, but it has now become obsolete here. At the present time it is principally consumed in Russia, where it is employed for flavouring the liqueur called *nastoika* and vinegar; and is a favourite spice and medicine among the Livonians and Esthonians. It is also used by brewers, and as a cattle medicine; and by the Tartars in the preparation of a kind of tea. It is also employed to some extent in India and elsewhere.

Guibourt, Hist. Nat. des Drogues simples, vol. ii, p. 200, 4th edit.; Pereira, Mat. Med., vol. ii, pt. 1, p. 257; Pharmacographia, p. 580; U. S. Disp., by W. & B., p. 1599; Morin, Journ de Pharm., vol. ix, p. 257; Hanbury, in Pharm. Journ., ser. 3, vol. ii, p. 248; Pharm. Journ., ser. 3, vol. viii, p. 88; Brandes, Archives der Pharm., vol. xix (1839), p. 52.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Kew Herbarium, collected on the south coast of China by Mr. Taintor.

1. Upper part of a flowering stem, with opening flowers.
2. A flower.
3. Anther and upper part of style.
4. Section of anther.
5. Vertical section of ovary showing epigynous "gland."
6. Rhizome.

(2–5 enlarged.)

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2
3
1
7
6
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N. Ord. Orchideæ. Lindl., Veg. K., p. 173; Le Maout & Dec., p. 769.

Tribe *Arethuseæ*.

Genus Vanilla,* *Swartz*. Lindley, Orchidaceous Plants, p. 434. Species 12, natives of tropical America.

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272. Vanilla planifolia, *Andrews, Bot. Repository, t.* 538 (1808).

Vanilla. *Baynilla* (Mexico).

Syn.—V. claviculata, *Swartz*. V. sylvestris? *and* V. sativa, *Schiede*. V. viridiflora, *Blume*. Myrobroma fragrans, *Salisb*.

Figures.—Hayne, xiv, t. 22; Berg & Sch., t. 23 a, b; Bot. Rep., t. 538; Salisb., Parad., t. 82; Blume, Rumphia, t. 68.

Description.—A fleshy, somewhat succulent, dark-green perennial climber, adhering to trees by its aërial roots, which are produced from the nodes, 5 or 6 inches long, simple, and covered with hairs at the middle portion. Stem cylindrical, slender, solid, fleshy, smooth, dark green, branched, very long. Leaves alternate, sessile, 4—6 inches long, oval, attenuate at the apex, narrowed into the slightly sheathing base, persistent, thick and tough, dark green, slightly paler beneath, veins invisible. Flowers 2 inches across, pale yellowish-green, sessile, in lax axillary spikes of 8—10; axis fleshy, pale green, tapering; bracts short, triangular, green. Perianth fleshy, articulated with the ovary which looks like a stalk to the flower, deciduous, of 6 leaves in two rows, outer row (sepals) free to the base, nearly equal, erect and slightly spreading, lanceolate-oblong, acute, with a central rib, inner row (petals) alternating with the last, and the two lateral ones similar to them in size and form, the anterior (labellum) very different, concave, combined at the base with the column, and with it forming a somewhat funnel-shaped tube, margin faintly bifid, finely crenate, recurved on all sides and crisped, yellow, tube warted within the orifice, and furnished about halfway down with a crest of small, transversely-placed, flat, triangular scales,

* *Vanilla* is the diminutive of the Spanish *vaina*, a pod.

General Characters, Varieties, and Composition.—The vanilla of commerce occurs in the form of fleshy, cylindrical, somewhat flattened, flexible, stick-like fruits, varying in length from 4 to 8 inches, and in thickness from about $\frac{1}{3}$ to $\frac{1}{2}$ an inch. The fruits taper in some degree towards their extremities, and are more or less bent at their base. Externally they present a dark brown or blackish colour, and a greasy shining surface, which is finely furrowed in a longitudinal direction, and often covered with an efflorescence of small whitish crystals. Each fruit is commonly split into two unequal parts (valves), and exhibits in its interior a multitude of very minute, hard, glossy, black seeds, imbedded in a soft, thick, brownish-black, oily pulp. Vanilla has a strong, peculiar, very agreeable, aromatic odour, and a warm, sweetish, aromatic taste. The interior portion is the most fragrant.

There are several varieties of vanilla found in commerce, as *Mexican* or *Vera Cruz, Bourbon, Mauritius, Java, La Guayra, Honduras, Brazilian*, &c. The finest kind is Mexican Vanilla; of which, however, we have different qualities, and its production has much declined of late years. These varieties of vanilla are doubtless derived from different species of *Vanilla;* the finest vanilla, such as the Mexican, is commonly said to be the produce of *Vanilla planifolia,* the species now under description. The official plant is, however, as already noticed, *Vanilla aromatica,* Swartz.

The delicious fragrance of vanilla is due to a peculiar substance, called *Vanillin* or *Vanillic acid,* which exists in the proportion of about 1 per cent. Vanillin is frequently found in the form of minute crystals in the surface of, or inside, the fruit; or it is dissolved in the viscid oily pulp in which the seeds are imbedded. When pure vanillin is in the form of hard, colourless, 4-sided, acicular prisms, with a vanilla odour, and somewhat pungent taste. It is very soluble in alcohol, ether, and the fixed and volatile oils; and its solutions feebly redden litmus. It is soluble with difficulty in cold water; but it dissolves in 11 parts of boiling water, but is again deposited on cooling. Vanillin fuses at about 180°, and may be sublimed unchanged. Vanillin has recently been

formed artificially by Tiemann and Haarmann, at Berlin, who regard it as the methylic aldehyd of *protocatethuic acid*. The other constituents of vanilla possess no special importance.

Medical Properties and Uses.—Vanilla is an aromatic stimulant, with a tendency towards the nervous system. It has also been regarded as an aphrodisiac. It has been employed as a remedy in hysteria, low fevers, impotency, &c. ; but its use as a medicine is obsolete in this country, although still sometimes employed on the Continent and elsewhere. It is also frequently used for flavouring certain medicines, as lozenges and mixtures, in the United States, &c.

The principal use of vanilla is in perfumery ; and for flavouring chocolate, various articles of confectionery, as ices, creams, &c., liqueurs, and other substances.

Per. Mat. Med., vol. ii, pt. i, p. 265 ; Pharmacographia, p. 595 ; U. S. Disp., by W. and B., p. 883 ; Journ. de Pharm., vol. xxxiv (1858), p. 401 ; Amer. Journ. of Pharm., Jan., 1866, p. 38 ; Stokkebye, in Wittstein's Vierteljahresschrift f. prakt. Pharm., vol. xiii (1864), p. 481 ; Journ. de Pharm., vol. xii (1870), p. 254.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Royal Gardens, Kew, flowering in May ; with the fruit added.

1. Portion of stem with a spike of flowers.
2. Vertical section of the column and labellum.
3. Front view of end of column, showing anther and upper lip of stigma.
4. Transverse section of ovary.
5. A pod.
6. A seed.
7. Section of the same.

(2–4 enlarged ; 6, 7 much magnified.)

D.Blair ad nat. del. et lith.

M&N.Hanhart imp.

IRIS FLORENTINA, *Linn.*

N. Ord. IRIDACEÆ. Lindl., Veg. K., p. 159; Le Maout & Dec., p. 782.

Tribe *Irideæ*.

Genus **Iris**,* *Linn.* Klatt, in Linnæa, xxxiv (1865), p. 603. Species about 70, natives of temperate and subtropical regions in both hemispheres.

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273. Iris florentina, *Linn., Sp. Pl., ed.* 2, *p.* 55 (1762).

White Flag.

Figures.—Steph. & Ch., i, t. 27; Nees, t. 56; Hayne, xii, t. 1; Berg & Sch., t. 10 f; Bot. Mag., t. 671; Fl. Græca, t. 39; Redouté, Liliac., t. 23; Reich., Ic. Fl. Germ., ix, t. 339.

Description.—A perennial, with a thick, fleshy, nearly cylindrical, pale yellowish-brown rhizome, creeping at or just below the surface of the soil, and reaching a foot or more in length, sometimes branching; each year's growth marked by a contraction so that the rhizome has a jointed appearance, giving off thick fibrous roots below and marked by the scars of the leaf-attachments. Leaves several in each bud on the last year's growth of the rhizome, a foot or more long, an inch or more wide, clear, pale rather glaucous green, parallel-veined, sword-shaped, acute, equitantly sheathing below. Flowering-stem (scape) much exceeding the leaves, cylindrical, solid, faintly striate, stiff, with 2 or 3 branches, each from the axil of a sheathing semi-leafy bract. Flowers large, solitary, at the end of the stem and branches, each surrounded by two bracts (spathe), one longer than the other, green at their lower part, pale brown and scarious above. Perianth epigynous, tubular below, tube about an inch long, thick, pale green, divided above into 6 large white, obovate-spathulate, waved, and crumpled segments, the 3 outer somewhat narrower, elegantly recurved, bearing on the middle line of the upper surface at the base a band of densely set filaments, white with bright yellow tips, on either side of which are branched,

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* *Iris*, the rainbow Goddess, from the beauty and variety of colour in the flowers of the genus.

curved, brownish veins; the 3 inner curved outwards and then upwards and inwards, meeting to form a dome in the centre. Stamens 3, inserted on the tube of the perianth at the base of the outer segments, curved outwards; filaments tapering, somewhat longer than the extrorse anthers. Ovary inferior, nearly sessile, oblong, cylindrical, with 6 furrows, fleshy, 3-celled; style 3-fid; stigmas 3, large, obovate, similar in texture and colour to the petals, spreading outwards and curving closely over the stamens, transversely cleft at the extremity so as to form a chink between two lips, the lower (outer) of which is short and narrow, the upper (inner) divided into two erect triangular segments, slightly laciniate on their outer margins; placentation axile; ovules numerous. Fruit (not seen) capsular, 3-celled, loculicidally dehiscing, stated to be about an inch long, longly acuminate, faintly triangular. Seeds (not seen; of the genus, horizontal, compressed, smooth, with a lax testa and a small embryo with inferior radicle in the axis of fleshy albumen).

Habitat.—Though named *florentina*, it is the opinion of D. Hanbury, who had studied it and its allies in the neighbourhood of Florence, that it is only a naturalised plant in that district, being truly indigenous to the coast region of Macedonia and the south-west shore of the Black Sea; it is also found in several other parts of southern and eastern Europe, growing in dry, stony places, but it is doubtful if it occurs in the Iberian Peninsula, though it grows in the Riviera. As a cultivated plant it is a very old inhabitant of our gardens, but is less common and more tender than *I. germanica*, L. Along with that species and with *I. pallida*, Lam., it is grown in large quantity near Florence for its rhizomes. Most botanists maintain these as separate species, but the distinctions are very slight. The colour of the flower of *I. florentina* is usually somewhat slaty, or even faintly bluish, but often pure white; it flowers in May, a little after the common garden flag.

Bertoloni, Fl. Ital., i, p. 231; Grenier & Godr., Fl. France, iii, p. 241; Roem. & Sch., Syst. Veg., i, p. 457; Klatt, l. c., p. 603; Lindl., Fl. Med., p. 575.

Official Part and Name.—Iris Florentina. The rhizome (U. S. P. *Secondary*). Not official in the British Pharmacopœia, or the Pharmacopœia of India.

Production and Commerce.—Orris rhizome, or orris root as it is commonly called, is derived indiscriminately in Tuscany, from three species of iris, namely, *I. florentina*, *I. germanica*, and *I. pallida*, the two latter species from being most abundant, probably furnishing the largest quantity. These species are known to the peasantry under the common name of *Giaggiolo*. The rhizomes are dug up in August, and are then trimmed, peeled, and dried in the sun, and are ultimately separated by the dealers who purchase them of the peasants into different qualities, *selected* and *sorts*. Orris rhizome is exported from Leghorn, Trieste, and Mogador.

General Characters and Composition.—Orris rhizome of commerce occurs in pieces of from 2 to 4 inches in length, and from about $\frac{1}{2}$ to $1\frac{1}{4}$ inch in width. These pieces present an irregular, somewhat conical form, with usually two or three short branches at their broader end. They have a flattened appearance, and are more or less arched, and frequently twisted, somewhat shrivelled, and furrowed. On the lower surface they are marked with small roundish scars, which are left by the cutting off of the rootlets. They are firm and compact in texture, and of a dull whitish colour. Their taste is bitterish, faintly aromatic, and subsequently acrid; and they have an agreeable violet odour. This odour is not present in the fresh rhizomes, which have simply an earthy smell, but is gradually produced by drying and keeping, not being fully developed until the rhizomes are two years old.

The principal constituent of orris rhizome would appear to be a solid crystalline substance, called *orris camphor*, which is always found on the surface of the distillate when orris rhizome is distilled with water. According to Umney, the yield of this substance is about 0·12 per cent. The authors of *Pharmacographia* believe the crystals which may be obtained from it, by purification, "to be simply *myristic acid*, impregnated with a little essential oil, which they obstinately retain." Orris rhizome also contains *resin* and some *tannic acid*.

Medical Properties and Uses.—Orris rhizome possesses cathartic and emetic properties, and was formerly much used on the Continent, &c., in dropsies, &c., and also, when powdered, as an errhine. It has been recently recommended by M. Allisiardi, of Saluzzo, in Italy, as a febrifuge. In France it is a good deal used for making issue-peas, for which purpose its agreeable odour, acridity, and power of absorbing moisture render it well adapted. It is sometimes given to infants during teething, to rub their gums with ; but this practice is objectionable, since it is not unfrequently attended with irritation of the mouth and disorder of the stomach and bowels.

Its chief application is at the present day to cover unpleasant odours in the breath, as an ingredient in tooth powders, and as a perfume ; for the latter purpose it is largely employed. An agreeable perfume, known as *essence of violets*, may be prepared by digesting one part of powdered orris rhizome in eight parts of rectified spirit.

Per. Mat. Med., vol. ii, part 1, p. 220; Steph. & Church., by Burnett, vol. i, pl. 27; Pharmacographia, pp. 599 & 601; U. S. Disp., by W. and B., p. 498; Per. Mat. Med., by B. and R. p. 446; Groves, in Ph. Jl., vol. iii, ser. 3, p. 229.

DESCRIPTION OF PLATE.

Drawn from specimens grown in Kew and Chelsea Gardens.

1. Flower with the perianth-segments removed.
2. Transverse section of ovary.

Iris versicolor, *Linn.*

Blue Flag (of America).

Official Part and Name.—The rhizome of this plant, which is

found in Canada and all parts of the United States of America, is also official, as follows :—IRIS VERSICOLOR. The rhizome (U. S. P. *Secondary*).

General Characters and Composition.—The fresh rhizomes resemble in appearance those of *Iris florentina* and the other species of *Iris* which form the orris just described, and like them they have an acrid taste, and no marked odour. Their properties are imparted to some extent to water by boiling, but more perfectly to alcohol; but we have no reliable evidence of their composition. By keeping, their acrimony and medical virtues are said to be impaired.

Medical Properties and Uses.—Blue flag rhizome possesses similiar medical properties to the orris rhizome already described, being purgative and emetic. But although official in the United States Pharmacopœia, it is but little employed in regular practice. Its chief use is by the class of irregular practitioners known in the United States as "Eclectics," who prepare from it an oleo-resin called *iridin* or *irisin*, which is believed to unite cholagogue and diuretic with aperient properties, and which a correspondent of the *Lancet* states to cause effects similar to those of a mixture of blue pill, aloes, and rhubarb.

U. S. Disp., by W. & B., p. 499; Lancet, Aug. 30, 1862, p. 239.

CROCUS SATIVUS, *Linn.*

D. Blair F.L.S. ad nat. del. et lith.

M & N Hanhart imp.

Tribe *Croceæ*.

Genus **Crocus**,* *Linn.* Klatt, in Linnæa, xxxiv, p. 674. There are about 50 species now known, natives of the Mediterranean region, Asia Minor, Syria, and Persia.

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274. Crocus sativus, *Linn., Sp. Plant., ed.* 1, *p.* 36 (1753).

Saffron.

Syn.—C. officinalis, var. *a, Hudson.* C. Orsinii, *Parl.*

Figures.—Woodville, t. 259; Hayne, vi, t. 25; Steph. & Ch., t. 101; Nees, t. 58; Berg & Sch., t. 1 d; Sowerby, E. Bot., t. 343; Reich., Ic. Fl. Germ., ix, t. 360; Nees, Gen. Fl. Germ.; Royle, Ill. Himal. Bot., t. 90.

Description.—A perennial herb with a solid, depressed-globular corm about an inch in diameter, giving off from its under surface several slender whitish roots, covered with a thin coating of several layers of fine longitudinal pale brown fibres (remains of leaves, &c., of previous year), and producing on the top one or more buds (new corms). Leaves produced from the new bud, few (6—9), very closely placed, sessile, forming an erect tuft, which is closely invested in its lower part by 4 or 5 large, broad, obtuse, thin, tough, membranous sheathing scales, 4—6 inches long, linear, acute, entire, stiff, curved outwards, smooth, shining deep green, with a white depressed midrib. Flowers 2 together, or solitary, appearing with the leaves and borne on a very short erect peduncle (scape) from a leaf axil, closely enveloped by a delicate membranous spathe which is bifid at the apex. Perianth very large, erect, monophyllous, regular, with a slender, delicate, cylindrical tube about 4 inches long and adherent to the ovary at the base, and 6 oblong-oval, blunt, concave segments, about 1½ inch long, in two rows, the outer rather the longer, glossy pale reddish-purple, finely striated. Stamens 3, inserted in the mouth of the tube opposite the outer segments, and much shorter than them, anthers linear, longer than the filaments, sagittate at the base, bright yellow. Ovary inferior, oblong, 3-celled, with nume-

* *Crocus*, κρόκος, saffron; the classical name.

rous horizontal or ascending ovules in two rows in each cell. Style very long and slender, colourless in the perianth-tube, which it exceeds, dividing at the level of the anthers into three yellow drooping branches which hang out of the flower and become gradually thickened and tubular upward, stigmas dilated, notched or jagged, and often split down one side, dark orange-coloured. Fruit not seen; of the genus an oblong, sub-triquetrous, membranaceous, 3-celled capsule, loculicidally dehiscent. Seeds numerous in each cell, sub-globose, with a fleshy testa and a small embryo in the axis of the fleshy endosperm.

Habitat.—The Saffron is probably native in Greece and Asia Minor, and perhaps also in Southern Italy and Persia, but it has been so long under cultivation that it is now difficult to say where it is truly wild. Its culture in the East goes back to remote antiquity. In Italy it was grown in the time of Pliny. To Spain it did not spread till the tenth century, reaching France in the fourteenth and England probably about the same time. In this country it was at the end of the sixteenth and beginning of the seventeenth centuries grown as a crop in Essex, about Saffron Walden, and in Cambridgeshire, chiefly about Hinton, but this has long ceased. There seems to be some uncertainty as to when its cultivation was given up; Stephenson and Churchill state so lately as 1829 that it was still carried on at Stapleford, and the plant has been included in some British Floras as occasionally found in a half-wild state. At the present day it is grown in Spain and France, Persia, North India and China.

The flowers appear in late autumn. The fruit appears to be rarely formed, and the plant has been supposed to be a hybrid, but Mr. Maw saw abundance of fruit and ripe seed at Athens. Though termed perennial, it must be remembered that each corm, which may be regarded as a joint of a short vertical rhizome, has but a duration of two years.

The wild Italian plant is considered a distinct species by Parlatore, who has named it *C. Orsinii* after its discoverer. The distinctive characters are but slight, and Mr. Baker recombines it with *C. sativus*.

Smith, Eng. Fl., i, p. 46; Gibson, Fl. of Essex, p. 311; DC. Geogr. Bot., p. 857; Royle, Ill. Himal. Bot., p. 371; Klatt, in Linnæa, xxxiv, p. 675; Parlatore, Fl. Ital., iii, p. 238; Lindl., Fl. Med., p. 576; Flück. & Hanb., Pharmacogr., p. 601.

Official Part and Name.—Crocus. *Saffron;* the dried stigma, and part of the style (B. P.). The dried stigma, and part of the style (I. P.). The stigmas (U. S. P.).

Collection and Preparation.—At the present time the Saffron plant is chiefly cultivated for commercial purposes in France, Spain, and Italy. It is also grown to a small extent in Austria, the United States, Greece, Persia, Cashmere, and China; but generally speaking it is far less cultivated than formerly. The mode of collection and preparation of saffron varies somewhat in different countries, although in all it consists essentially in removing the stigmas with the upper part of the style from the other parts of the flower, and afterwards drying the parts thus detached. In France, the flowers are gathered at the end of September or beginning of October, after which the stigmas with the end of the style, are quickly removed; and these parts are then immediately dried on sieves over a gentle fire, the drying process only taking half an hour. In the Abruzzi, as described by Henry Groves, the gathering takes place in the early morning, at the latter part of October and during the whole of November. The collectors are chiefly women, who are furnished for the purpose with wicker baskets, which they place on their arms, and as they pass along the furrows left as pathways between the ridges of saffron plants, they pluck the whole flowers and place them in their baskets, in which they carry them home; the stigmas being removed afterwards at leisure, and then dried. According to Dumesnil, it takes from 7000 to 8000 flowers to yield 17½ ounces of fresh saffron, which by drying is reduced to 3½ ounces. Formerly, saffron thus prepared was called *hay saffron* to distinguish it from another kind, in which the stigmas after being gathered, were dried between paper under pressure, and then formed into cakes, and therefore termed *cake saffron*. The latter is not now found in commerce, the so-called

cake saffron being composed of safflower and gum water made into a paste, and rolled out into flat reddish-brown cakes, each of which is about the size of a pancake, and half an inch thick.

General Characters and Varieties.—The official saffron or *hay saffron*, the only kind now known in the pharmacies, is a loose mass composed of the dried ends of the styles with their attached stigmas, entangled together. Each of the portions of which it is composed, when entire, is from an inch to an inch and a half long: the lower end, which corresponds to the upper part of the style, is narrow and yellow in colour; and the upper portion is composed of three long, deep orange-red stigmas, which are notched at their extremities. Saffron is difficult to powder, except when very recently dried, as it readily absorbs moisture. As seen in commerce, it is flexible, unctuous to the touch, with a peculiar, penetrating, aromatic odour, and a bitter, somewhat aromatic taste. It tinges the saliva yellow when chewed; and when rubbed on the moistened finger it produces an intensely orange-yellow stain. The authors of Pharmacographia state that the colouring power of saffron is so remarkable, that a single grain rubbed to fine powder with a little sugar, will impart a distinct tint of yellow to 700,000 grains (10 gallons) of water.

The varieties of saffron more commonly known in commerce are French, Spanish, and Italian, the former being usually the purer kind. Two sorts of Spanish saffron are also noticed under the respective names of Alicante and Valencia Saffron.

Adulterations.—On account of the high price of saffron it is liable to frequent and great adulteration. Thus, to give it flexibility and freshness, and to increase its weight, it is sometimes damped or oiled; this addition of water or oil may be readily detected by subjecting a small portion of the suspected drug to pressure between folds of white blotting paper, when if this become moistened or oily, the adulteration and its nature are manifest. Sometimes saffron is adulterated by the intermixture of the florets of Marigold (*Calendula officinalis*) dyed with logwood, or of Safflower (*Carthamus tinctorius*); or of other florets, as those of *Arnica montana*, species of *Puli-*

caria, &c.; or strips of petals. All these frauds may be detected by placing a small portion of the suspected drug in a glass of warm water, when the marked form of the saffron stigmas, with the attached portion of style, will at once be evident, and enable us to distinguish them from all intermixed florets, or petals.

Another by no means uncommon adulteration of saffron within the last few years, although apparently rare formerly, as it was only first detected in this country by one of us in 1866, is the intermixture of the dyed stamens of the saffron crocus; these may be detected in the same way as florets or petals, by placing a pinch of the suspected specimen in warm water, when the pale yellow stamens may be readily distinguished by their different appearance from the stigmas and style of the genuine drug. The admixture of fibres of shredded beef is also a common adulterant in Italy. For this purpose a suitable piece of beef is boiled, and then shredded into small fibres, which are stained with saffron water, dried, and then mixed with the drug. This adulteration may also be readily detected by putting a portion of the suspected saffron in warm water; and also by the peculiar odour evolved when such saffron is burned. Of late years another adulteration has also been very common; it consists in coating saffron with chalk previously coloured orange-red. A ready means of distinguishing this fraud is to take a few shreds of the saffron and stir them in a glass of water, when the water will at once become turbid by the separation of the carbonate of lime, which will soon fall as a white powder to the bottom of the vessel, and then if hydrochloric acid be added brisk effervescence takes place. In some cases, Hanbury found, that the weight of Alicante Saffron had been increased 20 per cent. by this fraudulent admixture. The admixture of other earthy matters has also been detected in saffron; and other modes of sophisticating this drug have been noticed, all of which may be readily exposed in the ways already described.

Composition.—The principal constituent of saffron is the colouring matter, which has long been distinguished under the name of

polychroite. It also contains both *cane* and *grape sugars, gum, volatile oil,* and other unimportant substances. The experiments of Weiss have shown that polychroite is a glucoside, splitting when treated with acids into sugar, volatile oil, and a new colouring matter, to which he has given the name of *crocin.* The polychroite obtained by Weiss is an orange-red, viscid, deliquescent substance, which, when dried over sulphuric acid, is brittle, and of a fine ruby colour. It is without odour, but having a sweetish taste; and readily soluble in water or spirit of wine, but only slightly soluble in absolute alcohol. *Crocin* is a red powder, insoluble in ether, and only slightly soluble in water, but readily soluble in alcohol or an alkaline solution. The odour of saffron is due to its volatile oil.

Medical Properties and Uses.—Saffron was formerly in great repute as a stimulant, antispasmodic, and emmenagogue; but at present it is scarcely ever employed in this country, or in the United States, as a medicinal agent, except that it is sometimes given to young children in exanthematous diseases from its reputed power of promoting the eruption. Its chief use in medicine is as a colouring and flavouring agent, for which purpose it is an ingredient in several official preparations.

Other Uses of Saffron.—Formerly saffron was a good deal employed as a dyeing agent, but in this country and elsewhere it has now been almost entirely superseded for such a purpose by less costly dye-stuffs. As a condiment it is, however, still much in use in various parts of the Continent, as in Austria, Germany, and Switzerland; and to some extent even in parts of Great Britain, as in Cornwall. In India saffron is extensively employed by the natives in their religious ceremonies, as also in medicine, and as a condimentary substance. Saffron is also used by bird fanciers, as they believe it assists the moulting of birds.

Per. Mat. Med., by B. & R., p. 444; Pharmacographia, p. 604; U. S. Disp., by W. & B., p. 347; Pharm. Jl., ser. 1, vol. viii, p. 171, and vol. xv, p. 226; Pharm. Jl., ser. 2, vol. ix, p. 28, ser. 3, vol. iv, p. 551, and vol. vi, ser. 3, p. 215; Maisch., in Amer. Journ. of Pharm., March, 1872, p. 110; Bentley, in Pharm. Journ., vol. vii, ser. 2, p. 452, with figures; Groves, in

Year Book of Pharmacy for 1875, p. 562; Hanbury, in Pharm. Journ., ser. 3, vol. i, p. 241; Ingham, in Pharm. Jl ser. 3, vol. i, p. 624; Weiss, Wiggers, and Husemann, *Jahresbericht* for 1868, p. 35; Stoddart, in Year Book of Pharmacy for 1876, p. 494.

DESCRIPTION OF PLATE.

Drawn from a specimen cultivated in Kew Gardens.

1. A plant in flower.
2. Upper part of flower, laid open.
3. A stamen.
4. Vertical—and 5. Transverse section of ovary.
6. Stigma.
7. Section of corm.

(3–6 enlarged.)

D.Blair F.L.S. ad sicc. del. et lith.

CRINUM ASIATICUM, *Linn.*

M & N. Hanhart imp.

N. Ord. AMARYLLIDACEÆ. Lindl., Veg. Kingd., p. 155; Le Maout & Dec., p. 786.

Tribe *Amaryllideæ*.

Genus Crinum,* *Linn.* Kunth, Enum. Plant., v, p. 547. There are about 50 species, natives of tropical regions in the old and new Worlds.

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275. Crinum asiaticum, *Linn., Sp. Plant., ed.* 1, *p.* 292 (1753).

Syn.—C. toxicarium, *Roxb.* C. bracteatum, *Willd.* C. arenarium, *Herb.*, &c., &c.

Figures.—Rumph., Herb. Amboin, vi, t. 69; Rheede, Hort. Malabar, xi, t. 38; Redouté, Lil., vi, t. 348; Bot. Mag., tt. 1073, 2231; Bot. Cabinet, t. 669.

Description.—A very large perennial herb, with a short, stout, broadly-fusiform, vertical rootstock, giving off from its sides numerous thick roots and many elongated stolons, and extended above into a large ovoid prolonged "bulb," a foot long. Leaves numerous, very large, closely placed on the axis of the bulb and with broad sheathing fleshy bases, elegantly curved and drooping, 2—4 feet long, rather variable in width (3—7 inches), acute, quite entire, nearly flat, deep green, smooth and glossy, with a broad thick midrib, the smaller veins not conspicuous. Flowers very large, on short thick pedicels, many (20—50) closely crowded in a very large umbel terminating a stout, somewhat compressed, stiff scape, which comes off from the axil of one of the lower leaves and is shorter than it; umbel surrounded by two large, reflexed, membranous, brown, spathe-like bracts, and with numerous, long, linear bractlets among the flowers. Perianth with a very long, slender, erect, cylindrical tube, 3 or 4 inches long, and six equal, lax, spreading or reflexed, oblong-linear, acute segments 2 or 3 inches long, white or slightly greenish, deciduous. Stamens 6, inserted at the mouth of the perianth-tube, filaments erect, rather shorter than the perianth-segments, deep pink above, anthers linear-oblong, versatile, 2-celled, yellow. Ovary inferior, ovoid, dark green, smooth, usually produced above into a beak $\frac{1}{4}$—1 inch long, 3-

* *Crinum*, from the Greek κρίνον, used by Theophrastus for a lily.

celled, with several ovules in each cell, style very long, slender, extending beyond the perianth-tube to the length of the stamens, green, stigma small, faintly 3-lobed. Fruit nearly globose, about 2 inches in diameter, crowned with the remains of the beak of the ovary, pericarp soft, membranaceous, thin, bursting quite irregularly, 1-celled, and containing 1 to 3 seeds. Seed very large and irregular in form, bulb-like, furrowed.

Habitat.—This very handsome plant is a native of many parts of tropical Asia, occurring under several different varieties in different countries. It is very abundant on the sea-coast in Ceylon, and also grows in wet swampy places on the Peninsula of India. It is also much planted there in gardens. South China, Java, Timor, and other of the Malayan Islands also produce it, and it extends to N. and E. Australia. It is naturalised in Mauritius and other tropical countries. As an ornamental stove plant this is well known, having been introduced into our houses in the early part of the last century, and there are numerous varieties in cultivation. Roxburgh considered his *C. toxicarium* to be well distinguished from *C. asiaticum* by the possession of a short but distinct stem, by its much broader leaves and much more numerous flowers in the umbel.

Roxburgh, Fl. Ind., ii, pp. 128 & 134; Benth., Fl. Austral., vi, p. 454; Herbert, Amaryllid., p. 243; Kunth, Enum. Plant., v, p. 547.

Official Part and Name.—Crini Radix; the fresh root (I. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of the United States.

General Characters and Composition.—In the Pharmacopœia of India, where it is improperly termed "Crini Radix," being in reality a bulb, it is described as follows:—"Bulbous, with a terminal stoloniferous fusiform portion issuing from the crown of the bulb; with an unpleasant narcotic odour; readily dried in the stove, and reducible to powder after desiccation." No chemical investigation of this drug, so far as we know, has been made.

Medical Properties and Uses.—In full doses it possesses emetic properties; and in small doses it is nauseant and diaphoretic.

The fresh root is alone directed to be used in the two official preparations of the Pharmacopœia of India, namely, "Succus Crini" and "Syrupus Crini." The dose of the former being from two to four fluid drachms every twenty minutes, until the desired effect is produced; and of the latter, about two fluid drachms as a nauseant and emetic for children, and repeated if necessary.

The dried sliced root may also be used as an emetic; but Waring states that in this case, double the dose of the fresh drug is required. O'Shaughnessy says that it acts without producing griping, purging, or other unpleasant symptoms. In a letter to the editor of the 'Pharmacopœia of India,' O'Shaughnessy also remarks, "that it is a good emetic and diaphoretic whenever ipecacuanha is not at hand, but that it should be regarded not so much as a substitute for that article, as a resource in case of need."

Pharmacopœia of India, p. 234; Lindl., Flor. Med., p. 571; O'Shaughnessy, Bengal Disp., p. 656.

DESCRIPTION OF PLATE.

Drawn from cultivated specimens in the British Museum herbarium.

1. Umbel of flowers, several of them cut off.
2. The whole plant with foliage and flowers; about $\frac{1}{12}$ nat. size.

E.Blair F.L.S. ad sicc del. et lith.

M & N. Hanhart imp

ARECA CATECHU, *Linn.*

N. Ord. PALMÆ. Lindl., Veg. K., p. 134; Le Maout & Dec., p. 811.

Tribe *Arecincæ*.

Genus **Areca**,* *Linn.* Kunth, Enum. Pl., iii, pp. 183—188.
Species about 20, natives of the tropics of the old world.

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276. Areca Catechu,† *Linn., Sp. Plant., ed.* 1, *p.* 1189 (1753).

Betel-Nut Palm. *Goovaka* (Sanskrit). *Pinang* (Malay).

Syn.—Areca Faufel, *Gaertn.*

Figures.—Hayne, vii, t. 35; Nees, t. 38; Roxburgh, Pl. Coromandel, i, t. 75; Martius, Hist. Palm, tt. 102 and 149, fig. 4; Blume, Rumphia, t. 102A.

Description.—A tree with a straight, slender, unbranched stem reaching 40 or 50 feet in height, about 20 inches in circumference, cylindrical, smooth, grey, marked at not distant intervals with regular rings of scars left by the fallen leaves. Leaves (fronds) few (6—9), all terminal, spreading, very large and long, pinnate; petiole thick, concave above, convex beneath, passing below into a large smooth membranaceo-coriaceous sheathing base, and above into the convex angular rachis; leaflets (pinnæ) numerous, opposite, the lower ones often 3 or 4 feet long, the upper ones much shorter and usually combined together and truncate, broadly linear, acuminate, stiff, smooth, plicate at their attachment to the rachis in parallel folds. Flowers unisexual, monœcious, small, very numerous, sessile on the elongated, slender, smooth branches of the very much ramified inflorescence (spadix), without bracts, the male very numerous, the female much fewer, occupying the base of the branchlets; the whole spadix about 2 or 3 feet long, coming off below the leaves, and at first entirely enclosed between two large boat-shaped, coriaceous, blunt, striate, brownish bracts (spathe). Male flowers:—Calyx deeply cut into 3 small, ovate, acute segments; petals 3, very much longer than the calyx, broadly ovate, acute, smooth, thick,

* *Areca*, the native Malabar name for the tree when young.

† The nuts afford an astringent extract analogous to that of *Acacia Catechu* (see no. 95).

striate, yellowish; stamens 6, filaments short, more or less combined into either 3 or a single fleshy central column, red, anthers dorsifixed, sagittate at the base, white; ovary represented by a small central fleshy body and three long reddish styles. Female flowers:—Sepals 3, broadly ovate, fleshy, rigid, very thick in centre, thin at the margins, concave, persistent; petals 3, like the sepals but thinner, persistent. Stamens none or represented by a little hypogynous 6-toothed ring; ovary large, ovoid, acute, smooth, pale below, blackish-purple above, 3-celled, with a single ovule in each cell; stigmas 3, triangular, acute, papillose. Fruit 2—2½ inches long, ovoid, somewhat tapering, surrounded at the base by the persistent perianth-leaves, smooth, orange-coloured when mature, pericarp (husk) at first soft, afterwards dry and composed of numerous, distinct, longitudinal fibres separating at the apex, 1-celled, with a single erect seed. Seed globose-conical, about an inch in diameter, flattened on the base, testa very thin, closely adherent, yellowish, covered with a network of fine veins, and sending irregular processes into the substance of the endosperm almost to its centre, giving the latter a mottled appearance (ruminate); embryo small, quite at the base of the seed, erect, endosperm very hard, white or pinkish, softer or often with a small cavity in the centre.

Habitat.—The Areca-nut Palm is found cultivated throughout the tropical parts of Asia, the hotter parts of Peninsular India, Ceylon, South China, the Philippine and other eastern Islands, and especially the Malay Archipelago, where it is considered to be originally indigenous. It is a well-known tree in India, being the most elegant Palm of that country. Like many other Palms, it flowers nearly all the year round. There is much variation in the form and size of the fruit, and Martius describes six varieties founded on its characters; in one form the husk is white.

There are trees in cultivation at Kew, the Regent's Park, and Glasnevin Gardens.

Roxburgh, Fl. Indica, iii, p. 615; Kunth, Enum. Plant., iii, p. 184; Blume, Rumphia, ii, p. 65; Royle, Illust. Ind. Bot., p. 399; Martius, Gen. et Sp. Palm, iii, p. 169.

Official Part and Name.—Areca; the seed (B. P. *Additions*, 1874). It is not official in the Pharmacopœia of India, or the Pharmacopœia of the United States.

Cultivation, Collection, and Commerce.—The Areca or Betel Nut Palm is very largely cultivated for the sake of its seeds in the warmer parts of India, China, and the Philippines; and also in the Malayan Archipelago and in other parts of Asia. The average annual produce of one tree is said to be 300 fruits, each of which contains one seed or nut. In Ceylon and the Indian Peninsula the fruits are gathered between the months of August and November. From Ceylon and the Madras Presidency alone there were exported to Bombay and other parts in 1873 over 130,000 cwt. of areca nuts, representing a money value of nearly £110,000 sterling. At Sumatra, Singapore, and other districts, there is also an enormous trade in areca nuts.

General Characters and Composition.—The *Areca Nut*, or *Betel Nut* as it is more commonly termed, is, on an average, about the size of a nutmeg; it is roundish-conical in form, flattened at its base, of a reddish-brown or rusty-grey colour externally, and marked conspicuously with a hilum and a network of veins, which give the surface a somewhat tesselated appearance. Areca nuts are hard, heavy, and difficult to break or cut; but when broken the nucleus is seen to present a somewhat marbled appearance like that of the official nutmeg, and caused by the passage inwards of the reddish-brown veins which are seen on the surface, into the whitish albumen or endosperm. The albumen is therefore of the kind called ruminated. At the base of this albumen the small conical embryo may be observed. Areca nuts have no marked odour, although they have been described as somewhat cheesy; but their taste is feebly astringent. In some districts the dark veins are regarded more especially as the seat of their astringency, hence the quality of areca nuts is judged of by the appearance they present when cut through. Thus, "if the white or medullary portion which intersects the red or astringent part be small, and has assumed a bluish tinge, and the astringent part is very red, the nut is considered of good quality; but when the medullary

portion is in large quantity the nut is considered more mature, and not possessing as much astringency, is not esteemed so valuable." This test of the quality of the nuts does not appear, however, to be founded on any reliable data.

According to Morin, areca nuts contain *tannic* and *gallic acids, gluten, red insoluble matter, fixed oil, gum, oxalate of lime,* and *lignin.* Flückiger and Hanbury found them to contain 14 per cent. of a *crystalline fatty matter, tannic acid,* nearly 15 per cent. of an *amorphous tannic matter,* 2·26 per cent. of a *brown ash,* containing *peroxide of iron* and *phosphate of magnesium;* and other substances. They also came to the conclusion "that *Catechin* is not a constituent of areca nuts, and that any extract made from them must be essentially different to the *Catechu* of *Acacia* or of *Nauclea* (*Uncaria*), and rather to be considered a kind of tannic matter of the nature of *Ratanhia-red* or *Cinchona-red.*"

Medical Properties and Uses. — Various practitioners have testified to the astringent properties of the areca nut, and its consequent efficacy in checking diarrhœa. The powdered seeds have also long been held in some reputation as an anthelmintic for dogs, and areca has been now introduced into the British pharmacopœia on account of its supposed efficacy in promoting the expulsion of the tapeworm in the human subject. It is also reputed to be efficacious against the roundworm (*Ascaris lumbricoides*). Dr. Barclay, who appears to have been the first practitioner who called attention to the remedial value of the areca nut in the expulsion of tapeworm, administered it in powder in doses of from four to six drachms, stirred up in milk. The worm, he says, is usually discharged from four or five hours afterwards, alive. The medicine was administered before breakfast, a smart purgative having been given the preceding day, and no food taken for at least twelve hours previous. Other practitioners have also testified to its value as an anthelmintic, but at present the results have not been such as to lead to the opinion that it is likely to form a valuable addition to our Materia Medica. Dr. Waring says, "Anthelmintic virtues have been assigned to the nut, but it can hardly have any claim to

this character, as amongst the Hindoos and Burmese, who use it habitually as a masticatory, intestinal worms (*lumbrici*) are almost universally met with.

Other Uses of the Areca Nut.—In conjunction with unslaked lime (*chunam*), and the leaves of *Chavica* (*Piper*) *Betle*, the *Betel Pepper*, areca nuts form the celebrated masticatory of the East, called *betel*. For this purpose the nut is either softened by boiling in water, or it is used in a young and tender state; it is then cut into small pieces, and rolled up with a little lime in the leaf of the Betel Pepper, and the whole chewed; but in some cases it is combined with aromatics, as cardamoms or camphor. This masticatory is regarded as a prophylactic against dysentery; but it is chiefly used to impart an ornamental red hue to the lips and mouth, and an agreeable odour to the breath. Its constant use, however, turns the teeth black.

In this country, and in the United States, and elsewhere, areca nut charcoal is used as a tooth powder. In reference to this, Pereira says, "I know of no particular value it can have over ordinary charcoal, except, perhaps, that derived from its greater hardness."

In the southern parts of India, and it is also said in Ceylon, an astringent extract is prepared from areca nuts, which was at one time considered to form part of the catechu of commerce, and was official in the Edinburgh Pharmacopœia. At the present time, however, we have no evidence of this catechu being an article of export to Europe, and it is stated by Drury to be a catechu of very inferior quality. The chemical composition of this extract, as already noticed, is also different from the ordinary kinds of commercial catechu.

Various other parts of the Betel Nut Palm are also used in the East; thus in some parts of India, the juice of the young leaves is mixed with oil to form a useful embrocation in lumbago and other painful local affections; the flowers are employed in Borneo mixed with other medicines as charms for the cure of many diseases; the spathes are made into drinking vessels, and are used for other purposes; the dry expanded petioles are said to

form excellent ready-made splints for fractures; and the various parts of this valuable palm are also applied to other useful purposes.

Per. Mat. Med., vol. ii, pt. 1, p. 153; Per. Mat. Med., by B. & R., p. 1067; Pharmacographia, p. 607; Pharmacopœia of India, p. 249; Ainslie, Mat. Med. Ind., vol. i, p. 65; Drury, Useful Plants of India, 2nd ed., p. 48; Tuson, Vet. Pharm., p. 43; Morin, Journ. de Pharm., vol. viii, p. 449; Jackson, in Pharm. Journ., ser. 3, vol. iv, p. 689, and Proc. Amer. Pharm. Ass. (1875), p. 127; Andrews, in Pharm. Journ., vol. iv, ser. 3, p. 649, and Proc. Amer. Pharm. Assoc. (1875), p. 128; Braithwaite, Retrospect of Medicine, 1863, vol. xlvii, p. 116; Amer. Jl. of Med. Sci., April, 1862, p. 496.

DESCRIPTION OF PLATE.

Drawn from Indian specimens in the British Museum, collected by Roxburgh; the reduced figure of the tree copied from Martius.

1. Sketch of the tree, very much reduced.
2. Portion of a leaf.
3. Small part of a spadix.
4. Several male flowers.
5. Petal of a male flower.
6. Vertical section of a male flower.
7. A stamen.
8. A female flower.
9. Sepal.
10. Petal.
11. Pistil from the same.
12. A ripe fruit.
13. Transverse, and—14. Vertical section of the same
15. The seed.

(4–10 enlarged.)

D.Blair F.L.S. ad nicc del. et lith.

M & N. Hanhart

ARENGA SACCHARIFERA, *Labill.*

N. Ord. PALMÆ.

Tribe *Arecineæ*.

Genus Arenga,* *Labill.* Kunth, Enum. Pl., iii, p. 197. Species 2 or 3, natives of Tropical Asia.

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277. Arenga saccharifera, *Labill., Mém. de l'Instit.*, iv, *p.* 209 (1803).

Syn.—Saguerus Rumphii, *Roxb.* S. Gamuto, *Link.* S. saccharifer, *Blume.* Gomutus saccharifer, *Spreng.*

Figures.—Rumph., Herb. Amboinense, i, t. 13; Mart., Hist. Palm., tt. 108 and 161, fig. 4; Blume, Rumphia, ii, tt. 123, 124.

Description.—A tree reaching a height of 40 feet. Stem thick, cylindrical, columnar, attaining 3 or 4 feet in circumference, smooth and irregularly ringed by the scars of the fallen leaves or with the lower part of the petioles persistent and clothing the stem with a thick network of black fibres. Leaves all terminal, very large, 15—25 feet long, pinnate; petiole thick, long, with a broad amplexicaul base fringed with abundance of tough, long, black fibres, mingled with long, stiff, woody processes, rachis stout, somewhat triangular, tapering, smooth; leaflets numerous, opposite or alternate, sessile, closely placed, 3—5 feet long, ensiform, with eared processes at the base on one or both sides, somewhat blunt or truncate and with small erose spinous denticulations at the apex, entire, smooth, with a strong quadrangular midrib, deep green above, pale and mealy beneath. Flowers unisexual, monœcious, numerous, sessile, with a cup formed of two (or more) small bracts at the base, the male usually in pairs on the lower spadices, the female less numerous, scattered solitarily on the branches, usually of the upper spadices; spadices several, 6—10 feet long, coming from among the bases of the leaves, pendulous, with numerous simple pendulous, slender, elongated branches, the base surrounded by several short, imbricated, deciduous bracts (spathe). Male flowers :—Sepals 3, rounded, fleshy,

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* *Areng* or *Aren*, the Javanese name.

concave, imbricate; petals 3, much longer than the sepals, oblong, concave, thick, leathery, valvate, purple outside, yellow within; stamens numerous, filaments short, anthers much longer, linear, cuspidate; no trace of a pistil. Female flowers:—Sepals 3, small, imbricated; petals 3, broadly oval, about three times as long as the sepals; stamens none or 3 sterile filaments; ovary large, 3-lobed, smooth, 3-celled, with a single ovule ascending from the base of the axis, style none, stigmas 3, conical. Fruit the size of a small apple, 3-lobed, depressed at the top, surrounded at the base of the persistent perianth-leaves, smooth, fleshy, indehiscent, yellow when ripe, 3-celled, with a single seed in each cell. Seed about $1\frac{1}{4}$ inch long, ovoid, pointed at the base where is the hilum, somewhat keeled on the ventral surface, convex on the back, testa hard, thin, black, nearly smooth; embryo small, situated just beneath the testa about half way down the convex back, endosperm hard, radiated, horny.

Habitat.—This fine palm is found in the Sunda, Molucca and Philippine archipelagos, and has been spread thence throughout Tropical Asia; it is cultivated in Malacca, Siam, and Cochin-China. It prefers damp situations, and in Java is found in the hills up to 1800 feet. It produces about 6 of its immense leaves annually, and is in flower nearly all the year through. The female flowers are sometimes found on the same spadices as the male, and abortive male flowers are frequently produced with the female ones; ripe fruits are only formed on the upper spadices; they are not rarely 2-celled from abortion; the pulp is very acrid.

Trees of this handsome species are in cultivation at Kew, Edinburgh, and Glasnevin botanic gardens.

Roxb., Fl. Indica, iii, p. 626; Marsden, Hist. Sumatra, p. 77; Kunth, Enum. Plant, iii, p. 197; Martius, Gen. et Sp. Palm, iii, p. 191; Lindl., Fl. Medica, p. 582; Blume, Rumphia, ii, p. 124.

Official Part and Name.—Sagus; the prepared fecula of the pith of Sagus Rumphii, and of other species of Sagus (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia

of India. Sago was, however, formely official in the London, Edinburgh, and Dublin Pharmacopœias.

Sources of Sago.—Sago is a kind of starch, which is obtained from the interior of the stems of species of *Metroxylon* (*Sagus*) and of allied palms, as for instance, that now under description; and also from species of *Cycas*, as *C. revoluta* and *C. circinalis*. The sago of commerce is, however, now most abundantly obtained from *Metroxylon læve*, but also to some extent from *Metroxylon Rumphii*, and *Arenga* (*Saguerus*) *saccharifera*. The kind of sago which is used in Japan and China is derived from one or more species of *Cycas;* and although *Cycas circinalis* and other species of *Cycas* were formerly recognised as one of the sources of sago in the Edinburgh and Dublin Pharmacopœias, a microscopic examination of the starch grains of these plants will prove that they differ both in size and shape from those of commercial sago, which, as just noticed, are derived from species of Palms.

The mode of obtaining sago, its general characters, composition, properties, uses, and all other details in reference to it, are described under *Metroxylon læve*.

Properties and Uses of Arenga saccharifera.—This palm, as its specific name implies, is one of the principal sources of Palm Sugar. Thus it supplies abundance of this sugar in the Moluccas and Philippines. Palm sugar is usually obtained by boiling the juice which flows out from this and some other Palms upon wounding their spathes and the surrounding parts. Palm sugar is known in India under the name of *jaggery*. The saccharine juice (*toddy*) of this palm also yields when fermented an intoxicating liquid. This is termed *neva* in Sumatra, and in Batavia a kind of spirit (*arrack*) is distilled from it.

When the trees are exhausted of their saccharine juice, sago of good quality is obtained from their stems. It is said that a single tree will yield from 150 to 200 pounds of this kind of starch. This palm is the source of a good deal of our commercial sago.

The black, stiff, strong, horsehair-like fibre, called *Ejow* or *Gommuti fibre* by the Malays, which is used for cordage, and

other purposes, is also obtained from the leaf-stalks of this palm; and several other products of minor importance are also yielded by it.

Per. Mat. Med., vol. ii, pt. 1, p. 142; Marsden, Hist. of Sumatra, p. 88, 3rd edit., 1811; Crawfurd, Hist. Ind. Archipelago, vol. i, p. 399; Lind., Veg. Kingd., 3rd edit., p. 136; Bentl., Man. Bot., 3rd edit., pp. 647 and 672; Pharm. Journ., vol. xi, ser. 1, p. 30.

DESCRIPTION OF PLATE.

The leaf and seeds from specimens from Java in the British Museum; the reduced figure of the whole tree after Martius; the flowers and fruit from Blume.

1. Sketch of the whole tree, very much reduced.
2. Portion of a leaf.
3. Portion of spadix with male flowers.
4. Calyx of male flower.
5. A single sepal.
6. A petal.
7. A stamen.
8. Portion of spadix with female flowers.
9. Vertical section of a female flower.
10. Horizontal section of ovary.
11. A ripe fruit.
12. Transverse section of the same.
13, 14. Seeds.
15. Vertical section of the same.

(7 enlarged.)

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METROXYLON SAGU, *Rottb.*

D Blair F.L.S. ad sicc. del. et lith.

M & N Hanhart imp

N. Ord. PALMÆ.

Tribe *Calameæ*.

Genus **Metroxylon**,* *Rottb.* Kunth, Enum. Plant., iii, p. 214.
There are 7 or 8 species, natives of tropical Asia.

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278. Metroxylon Sagu,† *Rottb. in Nye Samling af K. Danske Vidensk. Selsk. Skrift.*, ii, *p.* 527 (1783).

Sago Palm. Rambia, Sagu, &c. (Malay).

Syn.—M. Sago, *Koenig.* M. læve & M. inerme, *Mart.* Sagus lævis, *Jack, Blume, & auct. plur.* S. inermis, *Roxb.* S. Rumphii, *Blume* non *Willd.* S. Koenigii, *Griff.*

Figures.—Annals of Botany, i, t. 4; Griffith, Palms India, tt. 181, 182; Blume, Rumphia, ii, tt. 126, 127.

Description.—A tree reaching 40 or 50 feet in height, with a straight, cylindrical, thick, smooth, dirty-grey stem (5 or 6 feet in circumference), irregularly marked with annular scars of the fallen leaves, giving off at the base near the root numerous stolons, and clothed at the top with the dry brown persistent bases of the leaves, the exterior hard, the whole interior soft, dry, spongy, yellowish or pinkish. Leaves few, closely placed, forming a crown at the top of the stem, very large, 20 feet or more in length, erect, somewhat curved; petioles long, 7 or 8 inches thick at the lower part, dilated at the base into a thick sheath surrounding the stem, quite smooth, green; rachis quadrangular below, triangular in the upper part, keeled beneath; leaflets very numerous, opposite or alternate, sessile, the middle ones longest, 2½—3 feet or more, those at either end shorter, 1½—2 feet, straight, stiff, narrowly linear lanceolate, very acute and tapering, entire, coriaceous, smooth, prominently 3-veined, bright green above, paler beneath. Flowers hermaphrodite or unisexual or mixed in the same inflorescence, very numerous, small, sessile, each surrounded by three small ovate membranous bractlets which are smooth within, densely covered externally with orange wool and placed in the axil of a larger

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* *Metroxylon*, from μήτρα, marrow or pith; and ξύλον, tree.

† *Sagu*, one of the Malay names.

broadly ovate, rigid striate bract smooth on both surfaces; these are closely and spirally arranged round a slender cylindrical axis, and immersed in the short, very dense ferruginous wool which covers it, the whole forming a solid cylindrical blunt spike (ament), about 4 inches long and $\frac{3}{4}$ inch in diameter; spikes very numerous, on stout woody stalks, divaricately spreading upwards and downwards, alternately arranged on opposite sides (distichous) of curved horizontal, stiff, flattened branches about 1—2 feet long, the surface of which is hidden by large smooth, leathery, strong, brown bracts, one at each node, also including the peduncle of the spike; branches arranged like the spikes distichously in one plane, coming off from the axils of very large close amplexicaul bracts placed on a stout, woody rachis 6 or 7 feet long, at first erect, afterwards nearly horizontal; from 6 to 9 of these great primary branches unite below to form one vast inflorescence from the centre of the leaf-crown thus terminating the stem, about 10—15 feet in length, and covered before expansion by very large, thick, coriaceous, attenuated, brownish, rigid bracts forming a spathe. Calyx cup-shaped, rigid, striate, smooth, cut about half-way down into 3 oblong, obtuse, concave, erect lobes. Corolla twice as long as calyx, thinner, smooth, reddish or purplish, deeply cut into three ovate-oblong obtuse segments. Stamens 6, about as long as the corolla on the base of which they are inserted, anthers linear-oblong, dorsifixed, purplish. Ovary shortly stalked, bottle-shaped, covered externally with thick, smooth, whitish, inversely imbricated scales imperfectly 3-celled, with a single erect ovule in each cell, style conical, tapering, triangular, pointed. Fruit about the size of a small apple, $1\frac{1}{2}$ inch in diameter, nearly spherical, mucronate at the summit, entirely covered with very closely adpressed, rhomboidal, hard, smooth, polished, imbricated, convex, downward-pointing scales in about 15—20 vertical rows, largest in the centre and decreasing greatly in size to the summit and base, each marked down the centre with a furrow, yellowish-green tinged with red when fresh, bright yellow when dry, 1-celled, the endocarp dry, spongy, pale orange-coloured. Seed solitary, large, erect in the endocarp, subglobose with the base

often excavated, testa dark brown, thin, endosperm forming the bulk of the seed, very hard, ivory-like, embryo small, near the surface of the dorsal part of the endosperm.

Habitat.—This palm is especially abundant in Sumatra and its adjacent islands, and also grows wild in Java, Borneo, Celebes, Siam, and Malacca ; in the Moluccas it is found, but is probably only cultivated. It does not reach so far eastward as New Guinea and its neighbouring islands. Wet rich soil, especially at the base of mountains, are its favourite localities. It has not been grown as yet in any of our palm-houses in this country.

The life of the plant lasts for about 15 to 20 years, at the end of which period the terminal inflorescence is formed. Flowering is followed by the death of the tree, but in spite of the abundance of flowers very few fruits are formed. These occupy 2 or 3 years in ripening. Seeds are seldom perfected, the continuance of the plant being mainly effected by the numerous stolons ; in the abundant production of these the Sago differs from most palms. Griffith states that his *S. Koenigii* is commonly cultivated in Malacca, and that it differs from *M. Sagu* in the arrangement of the flowers. He also says that it has spines on the petioles, and is well represented by Rumphius's figure, t. 17.

The other species of Sago-Palm is *Metroxylon Rumphii,* Mart. (*Sagus Rumphii,* Willd. non Blume ; *Sagus genuina,* Blume ; *S. spinosus,* Roxb.) ; which is figured in Martius' great work on Palms, tt. 102, 159, and apparently in Rumphius' Herb. Amboinense i, tt. 17, 18. It can be recognised from *M. Sagu* by the petiole and leaf-rachis being armed with numerous straight brown thorns about an inch long. The range of this species is further to the east than the last, it is plentiful in all the western parts of New Guinea, and is found abundantly in the Moluccas, Mindanao, Gilolo, Ceram, Amboyna, &c., but is not known to occur in Timor or westwards of Celebes, being thus absent from Sumatra and Java. This tree has decided littoral tendencies, and is abundant along the shore of many small islands forming a dense impenetrable belt. The *S. vitiensis,* Wendl., of the Fiji Islands (beautifully figured in Seemann's *Flora Vitiensis,* t. 80), has been suggested by Beccari

to be only *M. Rumphii* brought from the Malay islands by currents; the fruit, however, looks totally distinct.

C. Koenig, in Annals of Bot., i, p. 123; Jack, in Hook. Comp. Bot. Mag., i, p. 266; Griffith, Palms of East India, p. 32; Roxb., Fl. Indica, iii, p. 623; Miquel, Fl. Ind. Batavæ, iii, p. 147; Blume, Rumphia, ii, p. 146; Seemann, Fl. Vitiensis, p. 278; Beccari, Malesia, fasc. 1, p. 91; Lindl., Fl. Med., p. 581.

Official Part and Name.—Sago; the prepared fecula of the Sagus Rumphii, and of other species of Sagus (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India; but it was formerly recognised in the London, Edinburgh, and Dublin Pharmacopœias.

The sources of Sago are referred to by us under *Arenga saccharifera,* and in our article on that plant it is also stated that the palm now under description is the principal botanical source of sago. The quantity of sago which may be obtained from this palm (*Metroxylon Sagu*) is enormous; thus, according to Crawford, 500 or 600 pounds is not an unusual produce for one tree; and Blume mentions 600 to 800 pounds as the quantity derived from a single tree.

Preparation.—The mode in which sago is obtained in the Moluccas is as follows:—At that period of its growth when the medullary matter is fully developed, which is before the appearance of the fruit, the tree is felled, and the trunk then cut into billets six or seven feet long, each of which is again split into two parts in order to facilitate the removal of its medullary matter. The latter is then extracted and reduced to a coarse powder like sawdust, and then, in order to separate the starch or fecula from the cellular and fibrous matters with which it is mixed, the coarse powder is mixed with water in a kind of trough, having a sieve at its end. The water containing the starch in suspension then passes through the sieve into a suitable vessel, leaving the matters with which it was mixed on the surface of the sieve. It is then allowed to stand until the insoluble fecula is deposited; after which the water is poured off, and the starch which

remains is again washed two or more times, and subsequently dried, when it constitutes the powder, which is termed *sago meal.* As seen in commerce, however, sago is commonly found in grains of various sizes, and therefore termed *granulated sago.* The mode of preparing this latter kind appears to vary somewhat in different localities, but it consists essentially in mixing the meal with water into a paste, and rubbing it through suitable sieves to cause its granulation. It is afterwards dried either in the open air, or more commonly in ovens at a temperature of about 140°, by which the grains become more or less horny and translucent. Forrest says that in New Guinea, granulated sago is made by mixing the sago meal with water and pressing the paste through a sieve into a very shallow iron pot held over a fire, by which it is made to assume a globular form; so that, he adds, our grained sago is half baked, and will keep long. This, also, according to Blume, is the process which is followed by the Chinese at Singapore; the meal being first repeatedly worked and dried. Blume adds, during the heating process the grains are constantly turned, and that, though quite white at the commencement, they become hard and somewhat pellucid during the process.

General Characters, Varieties, Commerce, and Composition.—Sago occurs in two states, as already noticed, that is, in the form of powder, when it is termed *sago meal,* and in grains, and then called *granulated sago.* It is imported essentially from Singapore and Sumatra. The average importation into this country exceeds 4000 tons annually.

1. *Sago Meal.*—This is rarely seen in commerce. It exists in the form of a fine powder, which is whitish, buff-coloured, or reddish. It has a faint, somewhat musty odour. Under the microscope it is seen to consist of irregularly oval, or more or less ovoid, usually isolated granules; these often appear truncated, owing to their mutual pressure, and thus become more or less mullar-shaped, or have a dihedral extremity. The granules are frequently more or less broken, and have an irregular or tuberculated surface. The hilum is circular when perfect, but it is

frequently cracked, either in the form of a single slit, or of a cross, or in a stellate manner. The surface of the granules is marked by concentric rings, but these are much less distinct than those of potato starch. The granules show a black cross, the centre of which is the hilum, when examined by the polarising microscope.

2. *Granulated Sago.*—This occurs in two forms, which are distinguished as *Common Brown* or *Borneo Sago,* and *Pearl Sago.* The latter kind is that now commonly in use. *Common* or *Brown Sago* occurs in irregularly rounded grains, varying in size from a white mustard seed to that of a small pea; the grains are whitish on one side and greyish-brown on the other. Under the microscope they are seen to consist of granules, like those of sago meal, but more broken and less regular in their shape. The grains are frequently mixed with more or less of a dirty yellowish-brown powder. *Pearl Sago* is prepared by the Chinese at Malacca and at Singapore. It is in small grains, which are usually about the size of a pin's head; these grains are hard, and ordinarily more or less translucent. They have no odour, and but little taste; they vary in colour, being whitish, brownish-yellow, or sometimes pinkish. The colour of the grains is commonly not uniform over the whole surface, but they are whitish on one side and coloured on the other. The grains are usually isolated, but in some cases two or three may be found adhering together. The grains may be rendered perfectly white by a solution of chlorinated lime. Under the microscope, pearl sago is found to consist of granules of the same characters as those of sago meal, but they are all the more or less ruptured, and present but indistinct traces of rings.

Sago has doubtless the same composition as other starches, but it has not been analysed; hence it possesses the same chemical characters as starch. Sago meal is insoluble in cold water, but by boiling in water it ultimately almost entirely dissolves, and forms a clear gelatinous solution; which, when cold, assumes a blue colour on the addition of a solution of iodine. Pearl sago is frequently partially soluble in cold water, which is doubtless owing to the heat used in its preparation having more or less broken up the granules of which it is composed.

Adulteration.—A factitious sago is sometimes prepared both in this country and abroad from potato starch. It occurs both white and coloured. The microscope will readily distinguish true from spurious sago, by the difference in the size, form, and other characters of the constituent granules.

Properties and Uses.—Sago is nutritive, easily digestible, and free from all irritating properties, hence it is frequently used as a food in febrile cases, and in convalescence from acute diseases. For this purpose it should be boiled in water or milk, and the solution, after being strained, may be sweetened with sugar, and flavoured with nutmeg or other spice, or with wine when its use is not contra-indicated.

Sago is also largely used as a dietetical substance in this country and elsewhere; it is commonly served up in the form of a pudding.

In the countries where it is found sago is made into cakes, which are baked and used as bread. It has been stated that two pounds and a half of this bread are sufficient to serve for a day's sustenance to a healthy full-grown man, and as a tree will yield on an average about seven hundred pounds of sago meal, it has been calculated that a single acre of land planted with three hundred trees—one seventh to be cut down every year—will maintain fourteen men.

Roxburgh, Flor. Ind., vol. iii, p. 623; Blume, Rumphia, vol. ii, p. 148; Crawford, History of the Indian Archipelago, vol. i, pp. 390 & 393; Forrest, Voyage to New Guinea, 2 ed., 1780, pp. 39—41; Per. Mat. Med., vol. ii, pt. 1, p. 142; Per. Mat. Med., by B. & R., p. 415; Johnston, Chemistry of Common Life, vol. i, p. 107; U. S. Disp., by W. & B., p. 763.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum from the botanic gardens of Calcutta and Buitenzorg (Java); the leaf added from Blume. 1. Part of extremity of one of the primary divisions of the inflorescence. 2. A flower-bract. 3. One of the bractlets which surround the flowers. 4. A flower. 5. Pistil. 6. Section of ovary. 7. A fruit. 8. Vertical section of the same. 9. Seed. 10. Portion of extremity of a leaf. 11. Sketch of the whole tree, very much reduced.

(2–6 enlarged.)

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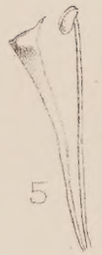
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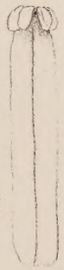
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D.Blair ad nat. del. et lith.

M&N.Hanhart imp.

ACORUS CALAMUS, *Linn.*

N. Ord. ARACEÆ. Le Maout & Dec., p. 831.

Tribe *Acoroideæ*. Lindl., Veg. K., p. 193 (N. Ord.).

Genus **Acorus,*** *Linn.* Kunth, Enum. Plant., iii, p. 87. Species 2 (or more?), natives of the northern hemisphere.

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279. Acorus Calamus,† *Linn., Sp. Plant, ed.* 1, *p.* 324 (1753).

Sweet Flag. Cinnamon Sedge.

Figures.—Woodville, t. 248; Barton, t. 30; Hayne, vi, t. 31; Steph. and Church, t. 32; Nees, t. 24; Berg & Sch., t. 8 c; Syme, E. Bot., ix, t. 1391; Schnitzlein, Iconographia, t. 72 bb; Nees, Gen. Fl. Germ.

Description.—An herbaceous perennial with a very long, indefinite, branched rhizome immersed in the mud, with short joints and large leaf-scars, cylindrical or somewhat compressed, about ¾ inch in diameter, smooth, pinkish or pale green, the leaf-scars brown, white and spongy within, giving off below numerous, long straight slender roots. Leaves few, distichously alternate, forming erect tufts at the extremities of the rhizome-branches 3 to 4 feet or more long, about an inch wide, broader at the insertion on the rhizome, tapering into a long acute point, entire, smooth, yellowish green, pink at the base, strongly conduplicate and equitantly sheathing below, sword-like above with the central portion thick and gradually narrowing to the entire edges which are usually somewhat wavy or crimped. Flowering stems (scapes) one or two, each arising from the axils of the outer leaves which they much resemble, compressed-triangular, solid, spongy. Flowers very small, sessile, densely packed on all sides of the axis so as to form a solid, cylindrical, tapering blunt spike (spadix) 2—4 inches long, often somewhat curved, really terminating the scape, but apparently lateral and projecting upwards at an angle from it, the direction of the scape itself being con-

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* *Acorus* or *Acorum*, in Greek ἄκορος, the classical name for the plant.

† The *Calamus aromaticus* of the mediæval druggists; and perhaps the κάλαμος ἀρωματικός of Dioscorides (but see also no. 297).

tinued by a tapering two-edged bract (spathe), 2—3 feet long, in all respects like the leaves. Perianth polyphyllous, of 6 leaves imbricated in two rows, erect, oblong-obovate, acute, scarious, thicker at the top and bent inward, one-nerved, whitish, inconspicuous and soon withering. Stamens 6, opposite to and as long as the perianth leaves, either free or very slightly united with their bases, filaments membranous, flattened, slightly tapering upwards, with a dark nerve up the centre, anthers small, readily detached, 2-celled, cells divergent at the base. Ovary large, exceeding the perianth and stamens, obovoid-top-shaped, trigonous but irregularly so from pressure of adjacent flowers, smooth, grooved along the angles, the exposed portion thick, pale green, bluntly pointed, the summit capped by the minute sessile stigmas, the lower portion thin and white, 3-celled, the lower part of the cells excavated in the substance of the spadix, filled with a brittle gelatinous substance in which the ovules are immersed; ovules very minute, 5 or 6 in each cell, forming tufts which are pendulous from the large placentas projecting from the upper part of the axis, and are surrounded at the base by a tuft of very fine hairs; coats of the ovule very distinct though extremely delicate and transparent, their mouths prolonged into tubes with a fringe at the orifice, the inner one protruded much beyond the outer, nucleus small, dark, club-shaped. Fruit (not seen) bluntly six-sided, prismatical-clavate, about $\frac{3}{4}$ inch in diameter in the thickest portion, herbaceous, indehiscent, 1—3 seeded. Seed with a thin testa, embryo in the axis of the horny endosperm, green, cylindrical, radicle next the hilum.

Habitat.—Though at the present day common throughout the continent of Europe, there is little doubt that the Sweet Flag is indigenous to more eastern countries. So far as Central and Western Europe is concerned it appears to have been almost certainly spread by means of botanic gardens since the end of the sixteenth century. Clusius first cultivated it at Vienna in 1574 from a root received from Asia Minor, and distributed it to other botanists in Belgium, Germany, and France. As is the case with other rhizomatous aquatics it is very readily propagated, and it

rapidly became established. In England it was probably introduced about 1596, being first grown by Gerard, who may have received it from Robin of Paris, who had it in cultivation a few years before; it is now found thoroughly wild on the margins of ponds and rivers in most of the English counties, and is in some districts very abundant; in Scotland it is scarce and evidently introduced. It is found in all European countries except Spain, and becomes more abundant eastward, and in Southern Russia, Northern Asia Minor, and Southern Siberia appears to be a native, extending also to India, China, and Japan; it is also found in the Northern United States of America, where according to A. Gray it is also truly indigenous. It is said to be grown to a small extent in Burma and Ceylon, and is common in gardens in India, but the wild plant is that generally collected for use especially in South Russia.

Though naturally an aquatic, the Sweet Flag will grow well in gardens, but under such conditions rarely flowers. Ripe fruit must be very rarely produced; we have never met with it in this country, or seen it in herbariums; it is somewhat differently described by writers. The leaves are much like those of *Iris*, but may be distinguished from that and from all others by the peculiar crimped edges of the leaves and their aromatic odour when bruised, or broken across. The delicate ovules form a beautiful and instructive subject for microscopic examination.

Several species have been described from India and China, which are probably mere varieties of *A. Calamus*. The small *A. gramineus*, Ait., of North China and Japan, is, however, generally allowed to be distinct.

Syme, E. Bot., ix, p. 11; Hook. f., Stud. Flora, p. 394; Watson, Comp. Cyb. Br., p. 348; Trimen, in Journ. Bot., 1871, p. 163; Ledebour, Fl. Rossica, iv, p. 13; Gren. & Godr., Fl. France, iii, p. 332; A. Gray, Man. Bot. U. States, p. 478; Benth., Fl. Hongkong., p. 345; Lindl., Fl. Med., p. 606; Schott, Prod. Syst. Anoid., p. 578.

Official Part and Name.—CALAMUS; the rhizome (U. S. P. *Secondary*). It is not official in the British Pharmacopœia, or

the Pharmacopœia of India. But it was formerly recognised in both the London and Edinburgh Pharmacopœias.

Collection.—The rhizomes of sweet flag should be collected late in the autumn, or in the spring; and after being carefully washed, and freed from their roots, dried with a moderate heat. In the process of drying they shrink to about half their original diameter, but their odour and taste are much improved. In Germany the rhizomes are sometimes peeled before they are dried, but such an operation materially injures their properties, as we have explained below in speaking of their general characters and composition. Formerly the London market was supplied from Norfolk and the banks of the Thames; but at the present time the rhizome is generally obtained from Germany, although in rare cases also from India. Flückiger and Hanbury believe that it is brought into Germany from Southern Russia.

General Characters and Composition.—Calamus or sweet flag rhizome as found in commerce, is in flattened, somewhat curved pieces, which are usually some inches in length, and from about half an inch to an inch in diameter. Externally it has a yellowish-brown or fawn colour, and is more or less shrunken and wrinkled; it is marked on its upper surface with the scars and fibrous vestiges of the leaves, and on its under surface with numerous little elevated pale-coloured circular dots with a dark centre; these latter indicating the points from whence the roots arose. The rhizome breaks with a short rough fracture, its texture is spongy or corky, and its colour internally is pale brown and somewhat roseate. Its odour is aromatic and agreeable; and its taste bitterish, aromatic, and pungent. The Indian variety is said to have a stronger and more agreeable flavour than that obtained in Europe or the United States of America. The rhizome deteriorates by keeping. The decorticated rhizome, which is sometimes imported from Germany, is in greyish-white spongy pieces of variable length. Its odour is similar to the rhizome as ordinarily prepared, but is not so powerful, as the receptacles containing the volatile oil of sweet flag to which the odour is due are more abundant in the external portions of the rhizome.

The decorticated rhizomes are therefore inferior to the ordinary ones of commerce.

The principal constituent of calamus or sweet flag rhizome is *volatile oil*, which can be obtained by distilling it in a fresh or dried state with water. The dried rhizomes yield about 1·25 per cent. of oil; this oil has a yellow colour at first, but becomes red by keeping, it is dextrogyrate, and to its presence calamus owes its odour and aromatic pungent taste. The rhizome also contains a bitter principle, termed *acorin*, which was first isolated by Faust in 1867, and determined by him to be a glucoside; it has since been described by Flückiger and Hanbury as a very bitter, perfectly crystalline body. To the presence of these two principles sweet flag rhizome owes its properties; the other constituents, such as *starch*, &c., are of no importance.

Adulteration.—The rhizome of the common Yellow Flag, *Iris Pseudacorus*, L., is sometimes mixed with that of the Sweet Flag rhizome when the latter is collected in this country; it is readily distinguished by its darker colour, different structure, and want of aromatic odour and taste.

Medical Properties and Uses.—Sweet flag rhizome was formerly much esteemed as an aromatic stimulant and mild tonic; but at the present day it is very rarely employed by regular medical practitioners, either in this country or in the United States, though, as stated by Pereira, it might frequently be substituted with good effect for the more costly oriental aromatics. The testimony of many physicians indicate that it is now too rarely prescribed. It has been from the earliest times one of the most popular remedies of the native practitioners of India; in which country it is to be met with in all the bazaars. Dr. A. T. Thompson and Dr. Royle speak highly of its value in intermittent fevers; either by itself, or in conjunction with other tonics. In Norfolk the powdered rhizome is still employed by the country people for the cure of ague. It has also proved very serviceable in flatulence, flatulent colic, and in atonic dyspepsia; and Pereira found it of especial value in the dyspepsia of gouty subjects. It is also a useful adjunct to tonic or purgative medicines in cases of

torpor of the stomach or alimentary canal. A good form of administration is that of the infusion made by macerating an ounce of the rhizome in sixteen ounces of boiling water, and given in doses of two or more fluid ounces; or it may be chewed habitually as a remedy in the forms of dyspepsia mentioned above. The candied rhizomes are employed by the Turks as a preventive against contagion. In India it is also used as an insectifuge and insecticide, especially in relation to fleas.

Besides its use in medicine it is also employed by snuff manufacturers, more especially in the form of the volatile oil. The latter is also sometimes used in the preparation of aromatic vinegar. When the rhizome is masticated it is said to clear the voice, and it is sold by herbalists for this purpose, and for flavouring beer. Johnston also states that it is used by the rectifiers to improve the flavour of gin; and that it is largely employed to give a peculiar taste and fragrance to certain varieties of beer. In the United States it is also used by the country people as an ingredient in making wine bitters.

Thomson's Lond. Disp., by Garrod, p. 104; Per. Mat. Med., vol. ii, pt. 1, p. 139; Pharmacographia, p. 614; Steph. and Church., Med. Bot., by Burnett., vol. i, pl. 32; U. S. Disp., by W. & B., p. 190; Ainslie's Mat. Med. (Madras, 1813), p. 54; Pharmacopœia of India, p. 249; Stille's Therapeutics and Mat. Med., 2nd edit., vol. i, p. 489; Johnston's Chem. of Common Life, vol. ii, p. 251.

DESCRIPTION OF PLATE.

Drawn from a plant collected at Barnes Common, Surrey.

1. A portion of the rhizome, with the base of the terminal tuft of leaves.
2. Upper part of scape bearing the spadix and spathe.
3. Portion of a transverse section of the spadix, showing vertical sections of four flowers.
4. A flower.
5. Perianth-leaf and stamen.
6. A stamen.
7. Diagram of the flower.
8. A tuft of ovules.

(3–6 enlarged; 8 greatly magnified.)

D.Blair F.L.S. ad sicc del. et lith.

ALLIUM SATIVUM, *Linn.*

M & N. Hanhart imp.

N. Ord. Liliaceæ. Lindl., Veg. Kingd., p. 200; Le Maout & Dec., p. 843.

Tribe *Allieæ*.

Genus Allium,* *Linn.* Kunth, Synopsis Pl., iv, pp. 379—459. Species nearly 200, natives of temperate and warm regions, chiefly of the Old World.

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280. Allium sativum, *Linn., Sp. Plant., ed.* 1, *p.* 296 (1753).

Garlic.

Syn.—Porrum sativum, *Reichenb.* A. Ophioscorodon, *Don.*

Figures.—Woodville, t. 256; Hayne, vi, t. 6; Steph. & Ch., t. 111; Nees, Supp.; Reich., Ic. Fl. Germ., x, t. 488.

Description.—A perennial herb, with a short axis, circular and flat on the top, giving off slender fibrous rootlets below, and from the crown several very thin, shining, papery scales which are large and much dilated below, and bear in their axils large, oblong-ovoid, pointed, solid, sessile bulbs, unequal, pressed together, and the outer ones curved, so as to form collectively an ovate, lobed, white, tapering "bulb." Flowering stem (scape) terminal, passing through the centre of the "bulb," quite smooth and shining, solid, 1½—2 feet high, the lower half surrounded by the leaf-sheaths, but itself leafless. Leaves 7 or 8, all from the root-stock, being the scales above described, each of which is continued upwards round the scape as a complete cylindrical membranous tube, obliquely truncate at the mouth, where is a short annular entire ligule; blade broadly linear, flat, spreading, subacute, glabrous, a foot or more long, bright glaucous green. Flowers sparingly produced, being mostly supplanted by sessile, ovoid or obovate, smooth, purplish-red, solid bulbils, covered with a membranous scale and tipped with an elongated, weak leafy point, and crowded together to form a globular head about 1 inch in diameter, which when young is enveloped in a large

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* *Allium*, garlic; in Greek σκόροδον.

membranous white bract (spathe), very much prolonged into a long, tapering, erect, horn-like beak, and soon caducous; the flowers are long stalked and project beyond the bulbils. Perianth divided very nearly to the base into 6 oval subacute segments, strongly imbricate in two rows, erect, somewhat connivent, one-nerved, membranous, dirty white or pinkish, the outer ones keeled. Stamens 6, inserted on the base of the perianth-leaves and shorter than them, filaments flat, dilated, and often slightly connected at the very base, those of the 3 inner very wide and with a long filiform process on either side exceeding the central antheriferous portion, anthers introrse, dorsifixed, 2-celled. Ovary globular-trigonous, 3-celled; style simple, persistent. Fruit very rarely produced; of the genus, a loculicidally 3-valved, 3-celled membranaceous capsule, tipped by the persistent style. Seeds usually 1 or 2 in each cell, attached by their inner sharp edge, rounded on the back, black, nearly smooth, testa membranaceous, embryo curved, somewhat eccentric in the fleshy endosperm.

Habitat.—Garlic appears to have been one of the plants cultivated in the earliest times. It was well known in ancient Egypt, and has been grown by all the nations of the East and the Mediterranean to the present day. It appears, however, to be certainly an introduction to Europe. Ledebour states that it occurs wild in the southern parts of the Songorian-Kirghiz desert, and De Candolle points out that like so many other useful plants its probable home is to be traced to Central Asia. It occurs in a semi-wild state in several parts of the Mediterranean district, where it is everywhere cultivated. In England Garlic is very little grown.

Though the plant is, in accordance with custom, termed perennial, it must be understood that each bulb has but an annual duration. The structure of the bulbils round the base of the scape and in the flower-head is in all respects similar, consisting of a thick, solid, fleshy outer coat (metamorphosed leaf) completely enclosing the young plant (bud) which occupies the centre, and is provided with a short axis and well-developed leaves, like the parent plant in miniature. The form of the bulbils is

liable to variation; in the variety called *A. Ophioscorodon,* Don., they are shorter and rounder.

The flowers appear in June and July, but they are often all supplanted by bulbils. All the six stamens sometimes have long lateral cusps to the filaments, instead of the inner three only.

A closely allied species is *A. Scorodoprasum,* Don., the Rocambole, said to be native in Greece and largely cultivated throughout Europe. The Onion is *A. Cepa,* Linn., the Leek *A. Porrum,* Linn., and the Shallot, *A. ascalonicum,* Linn.

Kunth, Enum. Plant, iv, p. 380; Ledebour, Fl. Rossica, iv, p. 162; Gren. & Godr., Fl. de France, iii, p. 196; DC. Géogr., Bot., p. 830; Lindl., Fl. Medica, p. 593.

Official Part and Name.—ALLIUM, *Garlic;* the bulb (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India, but it was formerly recognised in the London, Edinburgh, and Dublin Pharmacopœias. In the United States it is commonly known as English Garlic, to distinguish it from the wild plant of that country with the same name.

Preparation.—Garlic is dug up in the autumn from cultivated plants when the leaves begin to wither, and with a portion of the flowering stem attached; the bulbs are then cleaned, and after being dried in the sun they are tied in bunches, and thus brought into the market. They are said to lose in drying nine parts in fifteen of their weight, but with little loss of their sensible properties. They are best preserved by hanging them up in a dry place.

General Characters and Composition.—The bulb when dried is somewhat ovate in form, flattened below, and tapering upwards to the remains of the attached flowering stem. The bulb is compound; it is covered by a dirty white withered membrane, within which five, six, or more, small bulbs, called *cloves,* are contained, each of which is somewhat oblong in form, white, succulent, and juicy inside, and each having a distinct coat. Garlic has an acrid, biting, somewhat bitter taste; and a strong, disagreeable, pungent odour. All parts of the plant have a similar, though a less powerful, taste and odour.

The properties of Garlic depend on a volatile oil, which may be readily obtained by distilling bruised garlic bulbs with water in a large still. The oil passes over with the first portions of the water, the product amounting to 3 or 4 ounces from 100 pounds of the bulbs. As first obtained the oil is of a dark brownish-yellow colour, heavier than water, and decomposed at its boiling temperature. It has a most intense odour of garlic. When purified it is a colourless oil of great refracting power, and lighter than water. It boils at 284°, and may be distilled without decomposition. It smells like the crude oil, but less disagreeably. According to Wertheim, it consists of a peculiar radical called *allyl*, combined with one equivalent of *sulphur*, and is therefore a *sulphide of allyl*.

Medical Properties and Uses.—As a medicine garlic was held in great repute by the ancient physicians, and was also formerly much used in modern practice, but in this country it is now rarely used by the regular practitioner, although it is still employed to some extent in the United States. Garlic is stimulant, diaphoretic, expectorant, diuretic, and tonic, when exhibited internally; and rubefacient when applied externally. It is also regarded by some as anthelmintic and emmenagogue. When taken internally, or even when externally applied, the oil is speedily absorbed, and may be detected by its odour in various secretions of the body. In intermittent fevers it is a highly esteemed Hindoo remedy, and was formerly used in similar cases in this country and elsewhere. It has also been exhibited internally as a stimulant and stomachic in enfeebled digestion and flatulence; as an expectorant in old chronic catarrhs; as a diuretic in old atonic dropsies; in the nervous and spasmodic coughs of children; as an anthelmintic, especially in cases of ascarides; and in many other affections. At the present day, it is, however, more employed as an external remedy. Thus as a resolvent in indolent tumours; as a local irritant when bruised and applied to the feet, to act as a revulsive in disorders of the head or chest; as an antispasmodic liniment (composed of oil and garlic juice) in infantile convulsions and other spasmodic or nervous affections

in children; as a remedy in atonic deafness, when a clove or a few drops of the juice may be introduced into the ear; and in the shape of a poultice applied to the pubes, in retention of urine from debility of the bladder.

The bulbs of other species of *Allium*, more especially *Allium Cepa*, the Onion, have similar properties to those of garlic, but milder.

Garlic, Onion, and other species of Allium, are very extensively used in different parts of the world as condiments and flavouring agents.

Per. Mat. Med., vol. ii, pt. 1, p. 209; Thomson's London Dispensatory, by Garrod, p. 106; Steph. & Church., Med. Bot., by Burnett, vol. ii, pl. 111, Treasury of Botany, pt. 1, p. 39; U. S. Disp., by W. & B., p. 87; Watts, Dict. Chem., vol. i, p. 143; Sharp, in Proc. Amer. Pharm. Assoc., for 1864.

DESCRIPTION OF PLATE.

Drawn from a specimen grown in Kew Gardens.

1. A whole plant.
2. Vertical section of the base of the stem and bulb.
3. Vertical section of a single bulbil.
4. A flower.
5. The same, with the perianth removed.
6. One of the inner stamens.
7. Blade and part of sheath of a leaf.

(4–6 enlarged.)

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D.Blair F.L.S. ad sicc. del. et lith.

M & N. Hanhart imp.

URGINEA SCILLA, *Steinh.*

N. Ord. LILIACEÆ.

Tribe *Scilleæ*.

Genus Urginea,* *Steinh.* Baker, in Journ. Linn. Soc., xiii, p. 215. There are about 25 species, natives of the Mediterranean region, India, and Tropical and South Africa.

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281. Urginea Scilla,† *Steinheil in Ann. Sc. Nat., ser. 2, i, p.* 330 (1834).

Squill.

Syn.—Scilla maritima, *Linn.* Urginea maritima, *Baker.* Ornithogalum maritimum, *Lam.* Squilla maritima, *Steinh.* S. Pancration, *Steinh.* S. littoralis, &c., *Jord. & Fourr.*

Figures.—Woodville, t. 255; Hayne, xi, t. 21; Nees, t. 55; Steph. & Ch., t. 153; Berg & Sch., t. 6 a; Bot. Mag., t. 918; Redouté, Liliac., ii, t. 116; Jordan & Fourreau, Ic. Fl. Europ., tt. 201—4.

Description.—A perennial herb, with a short, thick, flattened hard axis or rootstock emitting beneath long tough cylindrical roots, and closely set above with very numerous large overlapping scales forming a tunicated bulb which is 4—6 inches long, nearly globular, but slightly produced at the top, the outer scales thin and papery, red, orange-brown, or dirty-white in colour, strongly veined with numerous parallel nerves, torn and usually truncate, the inner ones smaller, fleshy, closely investing one another, broad and blunt, curved, nerved like the outer ones, yellow or green where exposed to the air. Leaves few, large, 1½—2 feet or more long when fully grown, spreading and recurved, inserted at the base of the flowering stem, and appearing long after the flowers, narrowly oblong-lanceolate, tapering at the base, acute at the apex, variable in width, quite entire, dark glossy green, thick, rather wavy. Flowers numerous, on long slender pedicels, erect in bud, spreading during flowering, and again erect with fruit, each with a small lanceolate-linear, spurred bract at its base, rather

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* *Urginea*, from the name of an Arab tribe (Ben Urgin) in Algeria.

† Scilla, *σκίλλα*, the classical name for the plant.

laxly arranged in a very long, slender, erect raceme, 1—1½ feet long, the stout, smooth, cylindrical, purplish rachis continuing the bare erect scape of about the same length, which is given off from the axil of one of the leaves. Perianth-leaves 6 in two rows, nearly equal, very slightly connected at the very base, ⅜ inch long, spreading, persistent, oval, subacute, with a single faint midrib, white with a green tinge. Stamens 6, hypogynous, or very slightly attached to the base of the perianth-leaves, and shorter than them, filaments short, slightly flattened at the base, anthers oblong-oval, versatile, greenish. Ovary ovate-ovoid, sessile, faintly 3-lobed, smooth, shining, 3-celled, with numerous horizontal ovules, style about as long as the ovary, simple, stigma obscurely 3-lobed. Fruit a dry capsule about ½ inch long, on an erect stalk, and surrounded at the base by the shrivelled persistent perianth, oblong, blunt, deeply 3-lobed, 3-celled, pericarp dry and papery, splitting loculicidally, yellow. Seeds about 6 in each cell, ascending, imbricated, about ¼ inch long, flattened, obliquely obovate, testa membranous, dark purple-brown, finely reticulated, extended into a marginal wing, embryo cylindrical, straight in the axis of the fleshy endosperm.

Habitat.—This bulb is found in dry sandy places, especially the sea coast—to which, however, it is by no means confined—in most parts of the Mediterranean district. It is especially abundant in Southern Spain, and is found in Portugal, Morocco, Algeria, Corsica and most of the other islands, Southern France, Italy, Dalmatia, Greece, Syria, and various parts of Asia Minor. Its range also includes the Canary Islands and the Cape of Good Hope. The great bulb is usually only half immersed in the sand, and produces the long racemes of flowers in late autumn, the leaves following in early spring. The squill is grown in many botanical gardens, having been first recorded as cultivated in this country in 1629.

It is a variable plant; the bulb differs greatly in size and in colour, and the leaves and flowers also present similar varieties, which has led to the formation of several species. *Squilla Pan-*

cration,* Steinh. is distinguished by a bulb about half as large as the type.

A section of the fresh bulb of the squill is figured in Kunze's Pharm. Waarenkunde, ii, t. 17.

Gren. & Godr., Fl. France, iii, p. 184; Parlatore, Fl. Ital., ii, p. 454; Willk. & Lange, Prod. Fl. Hisp., i, p. 215; Kunth, Enum. Pl., iv, p. 332; Baker, in Journ. Lin. Soc., xiii, p. 221; Steinheil, in Ann. Sc. Nat., ser. 2, vi, p. 279; Lindl., Fl. Med., p. 591.

Official Part and Name.—SCILLA; the sliced and dried bulb (B. P.). The sliced and dried bulb (I. P.). The bulb (U. S. P.).

General Characters, Varieties, Preparation, and Commerce.—As seen in commerce the undried bulb is somewhat pear-shaped, and ordinarily about the size of a man's fist, but it is often larger, even sometimes equal in size to that of a child's head; its weight varies in a corresponding degree, from half a pound to more than four pounds. It has the usual structure of a tunicated bulb, being composed internally of thick, smooth, shining, fleshy, juicy scales, which are colourless or of a very pale roseate hue, and thin and delicate at their margins. These are closely applied over one another, and are invested externally by dry papery or membranous scales of a reddish, orange-brown, or whitish colour. The scales are attached below to a somewhat conical disc or contracted stem which projects inferiorly, and gives origin to the roots, the remains of which may usually be found in the bulbs of commerce. Squill bulb has but little odour, but its inner fleshy scales have a mucilaginous, bitter, acrid taste.

Two varieties of the bulb are distinguished in commerce, which are termed respectively *white* and *red* squill. The latter is so-called because it is covered externally by dry reddish-brown scales, and the inner fleshy ones are of a pale rose tint; while in the former variety, the outer and inner scales are all colourless. No difference can be detected in the medicinal properties of these two kinds of squill bulb, although the white variety is sometimes preferred.

For use in medicine the bulb is directed to be sliced and dried.

* Supposed to be the *πανκρατιον* of Dioscorides.

No directions are now given in our pharmacopœias for this process, but in the last London Pharmacopœia the bulbs before drying were directed to have their dry outer scales removed, then to be cut transversely into thin slices, and dried with a gentle heat at first, which was to be raised gradually to 150°. At the present time, however, squill is generally imported in ready dried slices from Malta, and usually packed in casks. For this purpose the bulbs are collected in the month of August, freed from their dry outer scales, and then cut transversely into thin slices, which are dried in the sun. On an average the bulb loses about four-fifths of its weight in the process of drying.

The dried slices as thus prepared are narrow, flattish or somewhat four-sided, curved, yellowish white or with a roseate hue according to the variety of squill from which they are obtained, from one to two inches long, translucent, flexible, brittle and pulverisable, scentless, and disagreeably bitter in taste. As dried squill readily absorbs moisture to the extent of about eleven per cent., it should be kept in well-stoppered bottles, or in a very dry place. When moist the slices become tough and cannot be reduced to powder. When powdered, unless carefully preserved in a dried state, it greedily absorbs moisture and forms a hard mass.

Composition.—The principal constituents of squill are *mucilage*, which is abundant; a bitter principle commonly termed *scillitin*; a non-volatile acrid principle named *skulein*; and bundles of needle-shaped crystals (*raphides*) of oxalate of calcium. According to Quekett, powdered squill contains about ten per cent. of these crystals; but Flückiger only found about three per cent. To the presence of these crystals, which are extremely sharp and brittle, Flückiger attributes the itching and redness, and even vesication, which results when a piece of fresh squill is rubbed on the skin; but other experimenters such as Tilloy and Chipman, attribute the irritation thus produced to the presence of a very acrid resinoid principle. *Scillitin* has been regarded by some as the active diuretic and expectorant principle of squill; and *skulein* as an irritant poison. According to Schroff, scillitin is a glucoside. It will be seen from the above statements, that the nature and properties of

scillitin, although it has been examined by several chemists, have never as yet been definitely determined; indeed it has not yet been isolated. But it has commonly been regarded as the active medicinal constituent of squill.

The recent examination of squill by E. Merck, indicate the presence of three distinct substances, which have been named *scillipicrin, scillitoxin,* and *scillin.* He also states that of these scillin, which he obtained as a light yellow, crystalline, tasteless powder, possessed the least activity; and he infers that the activity of squill as a medicine depends upon the two former; and that it is probably in scillitoxin that the peculiar active principle of squill is to be looked for.

Medical Properties and Uses.—In small doses squill is expectorant and diuretic; in larger doses emetic and purgative; and in over doses it acts as an irritant poison. It is generally used in combination with other emetics and expectorants, as thereby its effects are increased. As a diuretic it is most beneficial in dropsies, more especially in those resulting from cardiac disease; as an expectorant it is useful in chronic bronchitis, catarrhal affections, and asthma; but on account of its irritant qualities it should not be administered in diseases of an acute inflammatory nature. It has also been given as an emetic in whooping cough and croup, usually combined with ipecacuanha, but as an emetic it is very uncertain in its action.

Per. Mat. Med., vol. ii, pt. 1, p. 202; Per. Mat. Med., by B. & R., p. 440; Pharmacographia, p. 628; Christison, Disp., p. 836; U. S. Disp., by W. & B., p. 790; Pharm. Journ., vol. x, ser. 1, p. 359; Tilloy, Journ. de Pharm., vol. xxiii, p. 410; Chipman, in Proc. Amer. Pharm. Assoc., vol. xxiv (1876); E. Merck, in Pharm. Journ., ser. 3, vol. ix, p. 1038.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum from Teneriffe; the fruit added from another collected by the late D. Hanbury in Syria; the bulb and leaves from a specimen in Kew Gardens. 1. A plant with the flowering scape in blossom. 2. A flower. 3. A petal. 4. Transverse section of the ovary. 5. Part of the raceme of fruit. 6, 7. A seed. 8. Transverse section of the same. 9. A plant with fully-grown leaves, about $\frac{1}{5}$ nat. size. (2–4, 7, 8 enlarged.)

D.Blair F.L.S. ad nat. del. et lith.

M&N Hanhart imp.

ALOE VULGARIS, *Lam.*

N. Ord. Liliaceæ.

Tribe *Aloineæ*.

Genus Aloe,* *Linn.* Kunth, Enum. Pl., iv, pp. 492—548; Endlicher, Gen. Pl., p. 143. Over 170 species are described, natives chiefly of South Africa, a few in North Africa, Arabia, and India.

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282. Aloe vulgaris, *Lamarck, Encycl.*, i, *p.* 86 (1783).

Common Aloe. Barbados Aloe.

Syn.—A. barbadensis, *Miller.* A. perfoliata, var., *Ait.* A. elongata, *Murray.* A. indica, *Royle.* A. littoralis, *Koenig.*

Figures.—Flora Græca, t. 341, cop. in Steph. & Ch., t. 109, and Woodville, vol. v; Nees, t. 50.

Description.—A perennial plant with a very short, thick, cylindrical, simple, woody stem, sending out at the base numerous stolons; roots fibrous, fleshy. Leaves not very numerous, sessile, densely crowded on the short stem with wide dilated bases, spreading below, then ascending, 1 to 1½ foot long, tapering to a blunt point, very thick and fleshy, flat or rather concave above, convex beneath, the margins set with hard, distant, somewhat hooked prickles, surface quite smooth and shining, dark glaucous green, sometimes mottled. Flowering-stem (scape) 3 feet high, oblique at base, erect, stout, smooth, cylindrical, from the centre of the leaf-tuft, flowers stalked, numerous, erect in the bud, afterwards pendulous, arranged in a rather close, narrow, erect raceme terminating the scape, bracts exceeding the pedicels, membranaceous, triangular, acute, reddish, veined, persistent. Perianth gamophyllous, tubular, about 1¼ inch long, rather fleshy, bright yellow, deeply cut into 6 oblong, bluntish segments, the 3 outer a little shorter than the inner, which they closely cover, never spreading, persistent. Stamens 6, hypogynous, a little longer than the perianth, anthers small, oblong, dorsifixed near

* *Aloë*, in Greek ἀλόη, the classical name. (*Lignum Aloës*, the "aloes" of Scripture, is the fragrant resinous wood of *Aquilaria Agallocha*, Roxb., much used for incense in the East.)

the base, bright orange turning brown, ovary free, oblong-ovoid, bluntly triangular, 3-celled, with a double row of ovules in each cell; style about equalling the stamens, simple; stigma terminal. Fruit (not seen) an oblong-ovoid, very blunt capsule, about 1 inch long, bluntly trigonous, 3-celled, pericarp thin, leathery, greenish brown, smooth, dehiscing loculicidally. Seeds very numerous, compressed, testa thin and membranous, lax, forming a wide scarious wing; embryo in the axis of the endosperm.

Habitat.—This species of Aloe grows wild in Northern Africa, from Morocco eastward, and probably also in peninsular India. It is also found in the Canary Islands, and in Southern Spain abundantly, and may not improbably be indigenous. In Sicily, Greece, and the Archipelago it is usually considered to be an introduction. The plant has long been cultivated in the West Indian Islands, Jamaica, Antigua, and Barbados, and is now found in an apparently wild condition; it is probable that it was introduced at an early period from the Canary Islands, but some botanists consider it native. There do not seem to be any good grounds for the opposite supposition, held by Kunth, that this aloe was introduced from America into the Mediterranean region.

It is a plant readily propagated in suitable climates, and will grow in the driest situations and poorest soils, sending off abundance of radical offsets. It flowers in the summer, and is commonly grown in botanic gardens here; having been cultivated iu England so far back as the time of Gerard (1596); it requires heat in the winter and does not produce seed in this country.

The name *A. vulgaris* includes several forms which have been described as species, but in the want of good series of well-preserved specimens, it is not possible to trace out the synonymy. The *A. indica* of Royle is said by him to be common in dry situations in the north-western provinces of India, and also frequently cultivated in gardens; and is considered by Hanbury as but a slight variety of the present species. *A. littoralis,* Koenig, is described in his MSS. (in the British Museum) as growing abundantly in sandy maritime situations on the coast of Ceylon, and affording from its cut leaves a copious fœtid yellow juice.

There is also an authentic specmen of the plant, from which it appears to be probably a stunted small-flowered form of *A. vulgaris*. Both *A. indica* and *A. littoralis* have red flowers.

Roem. & Schultes, Syst. Veg., vii, p. 693; Kunth, Enum. Plant., p. 521; Willk. & Lange, Prod. Fl. Hisp., i, p. 201; Grisebach, Fl. B. West Indies, p. 582; Lindl., Fl. Ind., p. 594; Royle, Ill. Himalayan Bot., p. 390.

Official Part and Name.—ALOE BARBADENSIS; the inspissated juice of the leaf (B. P.). The inspissated juice of the leaf (I. P.). ALOE BARBADENSIS; the inspissated juice of the leaves (U. S. P.).

Situation of the Aloe juice.—The bitter juice which by inspissation forms aloes, is contained in vessels placed longitudinally beneath the epidermis of the thick fleshy leaves of this and other species of *Aloe*. When the leaf is broken, or cut transversely, the juice which then exudes is nearly colourless, but it quickly acquires a brownish-yellow colour from exposure to the air. The activity of this juice doubtless varies with the age of the leaf and the season of the year, but we have had no accurate experiments upon this head, although so far as the present plant is concerned, the juice would appear to be the most active in the spring of the year. In Curaçao, according to Haaxman, the bitter principles are at the maximum when the leaves are changing from green to brown.

Preparation.—In Barbados, where this species of Aloe is carefully cultivated for the production of the drug, the leaves are cut annually in March and April in the heat of the day; and this process of cutting does not sensibly injure the plants, as these are subjected to the same operation for several years. The finest kind of commercial Barbados aloes is obtained by evaporating the juice which flows spontaneously from the transversely cut leaves; for if pressure be employed the proper aloetic juice becomes mixed with the colourless, tasteless, mucilaginous liquid, with which the cells constituting the pulp of the leaf are filled, and thus an inferior kind of aloes is obtained. As a general rule the aloe juice is evaporated to a proper consistency by artificial heat; but it is said that occasionally a superior kind of aloes is prepared by exposing the juice in shallow vessels to solar heat until

completely hardened. Dr. Patrick Browne states that this sun-dried juice was formerly termed in Jamaica *Socotrine aloes.*

The process as now commonly adopted in Barbados for the preparation of the best aloes is as follows :—The leaves, which are cut off close to the plant, are put as quickly as possible, with their incised ends downwards in a V-shaped wooden trough, which is placed on an incline, and has a hole at its lower end, through which the juice as it runs from the transversely cut ends of the leaves down the sides of the trough, flows, and is received in a vessel placed beneath for that purpose. The juice is allowed to exude spontaneously, no pressure whatever being applied to the leaves. As the vessels become filled with juice, the latter is poured into a cask, and then either evaporated at once, or the juice, which is said not to injure in any degree, is kept at the pleasure of the manufacturer, for weeks or even months, before it is thus inspissated. This process of inspissation is usually conducted in a copper vessel, at the bottom of which a large ladle is placed, into which the impurities subside as the boiling proceeds, and are removed from time to time. When the juice has been sufficiently boiled, which is readily judged of by an experienced operator, the thickened juice is poured into large gourds or boxes, and allowed to harden. Hughes says that the boiling takes about five hours, and "the way to know when it is enough boiled is to dip a stick in the liquor, and observe whether the aloes sticking to it, when cold, breaks short; if it doth, then it is boiled to perfection."

Flückiger and Hanbury state that the troughs used for the purpose of receiving the leaves are about 4 feet long and 12 to 18 inches deep, and that it takes about a quarter of an hour to fill a trough. Five troughs are generally used for the purpose, which are so placed as to be readily accessible to the cutters, "and by the time the fifth is filled, the cutters return to the first and throw out the leaves, which they regard as exhausted. The leaves are neither infused nor boiled, nor is any use afterwards made of them except for manure."

General Characters and Commerce. — Barbados aloes varies in

appearance from a deep reddish-brown or chocolate colour to a dark brown or almost black. It breaks commonly with a dull conchoidal or waxy fracture; or sometimes it presents a smooth and glassy appearance when broken, and is then known in London as "Capey Barbados." This kind of aloes, by keeping, also presents a dull fracture. Barbados aloes is opaque in mass, but when small layers are held up to the light, they are commonly seen to be translucent, and of an orange-brown tint. In some cases, however, this variety of aloes is opaque even in small fragments. The powder of Barbados aloes is of a dull olive-yellow colour. It has a bitter nauseous taste, and a strong odour, which is especially developed when it is breathed upon, and which is commonly regarded as disagreeable. In Flückiger and Hanbury's Pharmacographia the odour is described as analogous to, but easily distinguishable from, that of Socotrine aloes. In the British Pharmacopœia it is stated that Barbados aloes "dissolves almost entirely in proof spirit, and during solution exhibits under the microscope numerous crystals."

Barbados Aloes is imported in boxes or gourds, but more commonly in the latter. The boxes usually hold about 56 lbs.; the gourds from 10 to 50 lbs. or more. The aloes is poured in a melted state through a square hole cut at the top of the gourd; and when the gourd is full, the hole in the shell is partially closed by replacing the piece and covering over it a portion of coarse cloth, which is nailed down over the aperture. In the year 1870 we imported from Barbados 970 cwt. of Aloes, and in 1871, 954 cwt. out of the total export of 1046 cwt. from that colony.

Other Varieties of Aloes. — Besides the official Barbados aloes of the British Pharmacopœia, the Pharmacopœia of India, and the Pharmacopœia of the United States, we have two other varieties of aloes which are official, namely, Aloe Socotrina in all the above-mentioned pharmacopœias, and Aloe Capensis in the Pharmacopœia of the United States only. The two latter varieties are described under "Aloe socotrina" and "Aloe ferox." Under these two plants some other commercial varieties

of aloes are also briefly noticed. In Tuson's Veterinary Pharmacopœia two varieties of aloes are mentioned, namely, "Aloe Barbadensis" and "Aloe Capensis."

The *Composition, Medical Properties, Uses,* and all other details respecting aloes are given under *Aloe socotrina* and *Aloe ferox.*

Per. Mat. Med., vol. ii, pt. 1, pp. 184 & 190; Per. Mat. Med., by B. & R., p. 428; Pharmacographia, p. 618; U. S. Disp., by W. & B., pp. 90 & 93; Hughes, Natural History of Barbadoes, p. 154; Tuson's Veterinary Pharmacopœia, p. 28; Trécul, Ann. des Sciences Nat., Bot., vol. xiv (1872), p. 85; Pharm. Journ., vol. x, ser. 1, p. 106; Craig, in Pharm Journ., vol. v, ser. 3, p. 827; Simmonds, in Pharm. Journ., vol. iii, ser. 3, p. 83; Med. Times and Gaz., Jan., 1868, p. 75.

DESCRIPTION OF PLATE.

Drawn from a plant in the Royal Gardens, Kew.

1. A flowering plant; reduced.
2. Raceme of flowers.
3. Upper portion of a leaf.
4. Vertical section of flower.
5. Stamens.
6. Transverse section of ovary.

(4–6 enlarged.)

D.Blair F.L.S. ad nat. del. et lith.

ALOE SUCCOTRINA, *Lam.*

Hanhart imp

N. Ord. Liliaceæ.

Tribe *Aloineæ*.

Genus Aloe, *Linn.*

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283. Aloe succotrina,* *Lam., Encycl. Meth.*, i, *p.* 85 (1783).

Socotrine Aloe.

Syn.—A. perfoliata, var., *Linn.* A. vera, *Mill.* (non *Linn.*). A. officinalis, *Forsk.?* A. purpurascens, *Haw.?*

Figures.—Woodville, t. 260; Nees, t. 51; Steph. & Ch., t. 110; Berg and Sch., t. 4 f; Hayne, xiv, t. 23 (*A. purpurascens*); Commelinus. Hort. Med. Amstelod., t. 48; Salm-Dyck, Aloe, tt. 22, 1, and 22, 2 (*A. purpurascens*); Bot. Mag., tt. 472, 1474.

Description.—A shrub with a stout, straight, cylindrical, woody stem, reaching 6 feet in height, strongly ringed with the scars of fallen leaves, and becoming, when old, dichotomously branched; stolons few or none. Leaves closely crowded at the ends of the branches to form large tufts, sessile, with dilated semi-amplexicaul bases, 15—20 inches long, curved at the base, then erect and slightly incurved, gradually tapering to an acute point, nearly flat or a little concave above, slightly convex beneath, with numerous sharp, white, spreading prickles on the margins, dull rather glaucous green, the older ones reddish at the ends. Flowering-stem exceeding the leaves, erect, slender, somewhat angular, purplish-green, flowers numerous, crowded, stalked, forming a narrow, erect spike-like raceme; pedicels slender, erect, curved when in flower, so that the flowers hang downwards; bracts shorter than the pedicels, broadly ovate, acute, with a wide amplexicaul base, often toothed, membranous, pinkish with dark veins, the lower ones distant and empty. Perianth about $1\frac{1}{8}$ inch long, orange-red or pinkish with greenish-white tips,

* *Succotrina*: "*Aloe succotrinum*" was the name of the drug in the 10 century. C. Bauhin derives it from *succus citrinus*, the powder being yellow; but it is more probably a corruption of *socotorina* or *socotrina*, from the island whence it was chiefly obtained. See 'Linschoten's Voyages' (1598), p. 128 (Eng. edition).

segments obtuse. Stamens equalling the perianth or three sometimes a little longer. The rest as in *A. vulgaris*.

Habitat.—The plant here described and figured is an old and well-known garden inhabitant, and without doubt the *A. succotrina* or *A. soccotrina* of botanists. It was first known to the Dutch, and was grown in the garden of Simon Beaumont in Holland, in 1689. Kiggelaer, who described the plant, says that it came "ex India orientali," though he also calls its "*succotorina* vera." We are not told the evidence on which this latter determination rested; nor indeed do we know where the species has ever been collected in a wild state in Socotra or elsewhere.

The aloe which is so abundant in Socotra has been seen by many travellers. Wellstead in 1835 describes it as growing abundantly in parched and barren places on the sides and summits of the limestone mountains at 500—3000 feet, especially on the west side of the island, where the hills for miles are thickly covered with plants. He adds that the plant "is too well known to need description." Whether this abundant plant is *A. succotrina* further examination must determine. That it is the present species may well be doubted, since an aloe undoubtedly gathered in Socotra by Mr. Wykeham Perry in 1878 (the only species he saw there) and sent in a living state to Kew (where, however, it has unfortunately not survived), was, as Mr. Baker informs us, a totally different species with short leaves.

We are indebted also to Mr. Jas. Collins, late Curator of the Pharmaceutical Society's Museum, for fragments of some leaves of an Aloe from Socotra of which he obtained living plants at Aden. These are much smaller than those of *A. succotrina*, and ovate or rounded at the base, and are apparently identical with Mr. Wykeham Perry's.

A. succotrina has been cultivated in England for over a century, and flowers annually in early spring in our greenhouses. *A. purpurascens*, Haw., differs in little besides its shorter and thicker leaves with coarser teeth; it is a native of South Africa. *A. officinalis*, Forsk., is a tropical Arabian plant and has been doubtfully referred to the present species; Forskål thought it probably yielded true official aloes.

Commelinus, Hort. Med. Amstelod., i, p. 91 (1697); Miller, Gard. Dict., ed. 8, n. 15 (1768); Forskål, Fl. Ægypt. Arab., p. 73 (1775); Kunth, Enum. Plant., iv, p. 524; Lindl., Fl. Med., p. 594; Wellstead, in Journ. R. Geogr. Soc , v, p. 197 (1835); Flück. & Hanb., Pharmacogr., p. 616.

Official Part and Names.—ALOE SOCOTRINA; the inspissated juice of the leaf of one or more undetermined species of Aloe, *Linn.* (B. P.). The inspissated juice of the leaf (I. P.). ALOE SOCOTRINA; the inspissated juice of the leaves (U. S. P.). It is commonly known as Socotrine Aloes; but also under the names of Bombay, East Indian, and Zanzibar Aloes. When opaque and liver-coloured, it is also known as Hepatic Aloes. The very inferior kind of aloes, which constitutes the Mocha or Moka Aloes, of Pereira, and some other pharmacologists, is thought by Flückiger and Hanbury, to be a kind of Socotrine Aloes. It is sometimes imported in a fluid state, and is then termed Liquid Socotrine Aloes, or Socotrine Aloe Juice.

Preparation and Commerce.—The situation of the bitter juice which by inspissation forms the official aloes, and also the mode in which aloes is prepared in Barbadoes, are fully referred to under "Aloe vulgaris."

We have no definite information of the mode of preparing Socotrine Aloes, or even of the particular districts in which it is carried on. Pereira states, that "in the Island of Socotra the leaves are plucked at any period, and by any one who chooses to take the trouble; and after being placed in a skin, the juice is allowed to exude from them." The following mode of preparing Socotrine Aloes, as related by Hermann, was communicated to Ray, by Dr. Palmer :—"When the leaves which have been pulled from the roots are gently compressed by the hand or an instrument, the juice drops from them into a receiving vessel; and being allowed to stand during a night, deposits the grosser parts. The next day it is transferred to another vessel, in which it is exposed to the sun that it may harden and become dry, when it acquires a brownish-yellow colour."

It is imported by way of Bombay in boxes lined with tin, and

in kegs. It is carried to Bombay by the Arab traders from the African coast, the Red Sea ports, or by way of Zanzibar, from Socotra.

General Characters and Varieties.—Socotrine aloes occurs in masses which are generally of a reddish-brown colour; but the colour varies in different parts of the same mass. The reddish tint is also liable to great variation, thus sometimes the masses are garnet-red, at other times they are much paler, and when quite dry are golden-red, and yield a golden-yellow powder. By exposure to air the colour is deepened. The fracture is usually smooth and resinous, but sometimes rough and irregular. In thin films it is usually nearly transparent. The odour of socotrine aloes, especially of freshly broken pieces, when breathed upon, is strong, peculiar, and agreeable; it is described by Flückiger and Hanbury, as comparable to myrrh or saffron. The varying odour of the different kinds of aloes is especially relied on by dealers as a distinguishing character between them. Its taste is very bitter. It dissolves entirely in proof spirit; and during solution exhibits under the microscope numerous minute crystals.

As already noticed, this variety of aloes is sometimes brought over in a fluid state, when it is known as *Liquid Socotrine Aloes.* This kind, like that of ordinary socotrine aloes, is obtained from Bombay. When freshly imported its consistence is that of treacle or very thin honey; its colour deep orange or palm-oil yellow; its odour powerful, fragrant, and resembling that of fine socotrine aloes. By standing, it separates into two parts,—an inferior, the larger portion, being opaque, orange-brown, and crystalline; and an upper portion, which is dark coloured and transparent. It was from examination of *liquid socotrine aloes* that Pereira was led to the belief that both socotrine aloes and hepatic aloes were derived from the same botanical source; and there can now be no doubt that the *hepatic aloes,* as formerly distinguished from socotrine aloes by its opacity and liver colour, although resembling it in odour, and supposed to have a different botanical source, was doubtless a form of socotrine aloes which owed its opacity to the crystals it contained. But much of the hepatic aloes of the

present day, however, does not owe its opacity to the crystals, but to the presence of some feculent matter. It should also be noticed that the term *hepatic* is now applied to any aloes which has a liver colour; thus we have, as is noticed in our description of Cape aloes under "Aloe spicata," *hepatic cape aloes*, as well as *socotrine cape aloes*.

Composition.—The principal constituents of the different varieties of aloes which are described by us under "Aloe vulgaris," "Aloe socotrina," and "Aloe spicata," are, a *volatile oil*, *aloin*, and *resin*. The odour of aloes is due to the *volatile oil*, which the drug contains, however, in but very small proportion. Thus, T. and H. Smith, of Edinburgh, only obtained from 400 pounds of aloes about one fluid ounce of volatile oil. It is described by them as a pale-yellow mobile liquid, of about specific gravity 0·863, and with a boiling point of between 510° and 520°. *Aloin* was first discovered by T. and H. Smith in Barbadoes aloes, but it has since been obtained from the other varieties of aloes. It is said to exist in two forms in nearly equal proportions, the *crystalline* and *amorphous*, which together, make upon an average, about 60 per cent. of the crude drug. The proportion of aloin varies however, in the different kinds of aloes. The crystallised form is supposed to be a hydrate or hydrid of amorphous aloin. The experiments of Tilden, Flückiger, Groves, Histed, and others, have shown that the crystallised aloins obtained from different varieties of aloes are not identical substances; hence that derived from Barbadoes aloes is termed *Barbaloin*, that from Socotrine aloes *Socaloin*, and that from Natal aloes *Nataloin*. *Barbaloin* is a neutral substance, crystallising in tufts of small yellow prisms; sparingly soluble in water or spirit of wine at ordinary temperatures, but very freely in either liquid if warmed; it is insoluble in ether. It is inodorous, but has a very bitter taste. Histed thus distinguishes the different aloins:—A drop of nitric acid on a porcelain slab gives, with a few particles of barbaloin or nataloin, a brilliant crimson, but produces little effect on socaloin. To distinguish the two former, mix a minute quantity of each with a drop or two of oil of vitriol, and then allow the vapour from a rod

moistened with nitric acid to pass over their surface, barbaloin will then undergo no change, but nataloin will assume a fine blue colour. For other distinguishing characters we must refer to special treatises on chemistry and pharmacology.

The name of *resin of aloes* has been applied to the substance which is deposited when a decoction of aloes cools. It differs, however, from ordinary resins, in being soluble in boiling water. It is transparent, brown, and soluble in alcohol, ether, and alkaline solutions. It is contained in aloes in the proportion of about 30 per cent. Tilden and Rammell have demonstrated that, by prolonged treatment in boiling water the resin of aloes is separated into two bodies, which they regard as kinds of anhydrides of barbaloin, and which they have named *Soluble Resin A.*, and *Insoluble Resin B.* The portion of aloes which is insoluble in cold water, and known as *resin of aloes,* was formerly distinguished from the soluble portion, which was termed *Aloetin* or *bitter principle of Aloes.*

Therapeutical Value of Aloin and the other Constituents of Aloes. —Great difference of opinion exists as to the source of the medicinal activity of the different kinds of aloes. Thus, Dr. Craig says, "Aloin is the only active principle contained in aloes, and possesses all the properties of the crude drug, and is free from griping;" and again, "the resin of aloes, when thoroughly exhausted of aloin, possesses no purgative properties." Dr. John Harley's experiments, however, do not support this statement, for he found that two grains of the pure resin taken with three grains of soap purged him freely, without causing any griping; but he adds, the cathartic action of the resin is far inferior to that of barbaloin. Dr. Craig, in commenting upon these experiments, says that the resin of aloes with which Dr. Harley experimented was not pure, but contained aloin. Drs. Garrod and F. Farre also describe the resin as almost inert. Mr. A. P. Brown, of the United States, also found that no purgative effect was caused by the resin.

In reference to aloin, Harley says "that the action of aloin is at least twice as strong as that of the best aloes, and this,

according to Mr. Finlay Dun, of the Edinburgh Veterinary College, is very marked in the horse. He states that 160 grains of aloin is equivalent to 8 drachms of crude aloes." From some experiments made by Mr. Dobson, at the request of Dr. Tilden, in the Bristol General Hospital, he found that while barbaloin, socaloin, and nataloin, all caused a laxative action, that of barbaloin having the most marked effect, they were uncertain and variable in their action, and seemed "to present no advantage over an equal dose of aloes, except, perhaps, that griping was rather less common than when aloes alone was given." The experiments of Mr. A. P. Brown of the United States, also led him to the conclusion that aloin was not more active than aloes when given in the same doses, but that it had the advantage of not griping. Observations to the same effect have been narrated by other experimenters, hence, it must be concluded that before aloin can be regarded as a thoroughly reliable substitute for the crude drug, further experiments are necessary.

Medical Properties and Uses.—In small doses aloes acts as a tonic and stomachic; and in large doses as a purgative, and indirectly as an emmenagogue. It acts especially on the large intestines, sometimes causing hæmorrhoids; hence, its use should be avoided when there is any inflammatory action present in the abdominal organs, or where there is much tendency to hæmorrhoids. It often causes much griping, an effect which has been ascribed to the resin, but this has been disproved by Garrod and F. Farre. The preparations of aloes are of much value in cases of habitual constipation, from the little tendency they have to cause subsequently a confined state of the bowels. Aloes is very frequently prescribed in combination with other drugs, as with tonics and stomachics, in chronic dyspepsia; with aloes and myrrh in amenorrhœa; and with other purgatives, as rhubarb, scammony, and colocynth, to promote the secretion of bile, and when full cathartic effects are desired. Aloin has been given in similar affections, but with varying effects, as already noticed. When dissolved in glycerine aloes acts favourably as a local stimulant in skin diseases.

Per. Mat. Med., vol. ii, pt. 1, p. 186; Per. Mat. Med., by B. & R. p. 429; Pharmacographia, p. 622; U. S. Disp., by W. & B., p. 91; Royle, Mat. Med., by J. Harley, p. 396; Pereira in, Pharm. Jl., ser. 1, vol. xi, p. 439; Squibb, in Pharm. Jl., ser. 3, vol. iii, p. 994; Flückiger, in Pharm. Jl., vol. ii, ser. 3, p. 193; Tilden & Rammell, in Pharm. Jl., ser. 3, vol. iii, p. 235; Tilden, in Pharm. Jl., ser. 3, vol. iii, p. 234; vol. vi, ser. 3, p. 208; vol. vii, ser. 3, p. 264; and vol. viii, ser. 3, p. 231; Dobson and Tilden, in Med. Times and Gazette, Aug. 12, 1876, and Pharm. Jl., ser. 3, vol. vii, p. 155; Mitchell, in Pharm. Jl., ser. 3, vol. vi, p. 675; Brown, in Proc. Amer. Pharm. Assoc., vol. xxv, (1877), p. 401; Craig, in Pharm. Jl., ser. 3, vol. v, p. 827; Craig, in Edinburgh Medical Journal for May and June, 1875, and April, 1877.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Royal Gardens, Kew.

1. Upper part of the flowering stem.
2. Vertical section of flower.
3. Transverse section of ovary.
4. End of a leaf.
5. Upper portion of the plant, reduced.

(2, 3 enlarged.)

D.Blair, F.L.S. ad nat. del. et lith.

ALOE SPICATA, *Linn. fil.*

M & N. Hanhart imp.

N. Ord. Liliaceæ.
Tribe *Aloineæ*.
Genus Aloe, *Linn.*

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284. Aloe spicata, *Linn. fil., Supplem. Plant., p.* 205 (1781).

Cape Aloe.

Not previously figured.

Description.—A shrub with an erect, cylindrical, unbranched stem, reaching 3 or 4 feet in height, and clothed with the long, persistent, close, parchment-like, pale yellow sheaths of the past leaves. Leaves few, less closely placed than in the two previous species, completely embracing the stem at the base, and forming thick, close, overlapping sheaths with a thin, sharp truncate upper edge, large, about 2 feet long, much incurved and deflexed, gradually tapering to the obtuse apex, slightly concave above, more strongly so beneath, thick and fleshy, becoming nearly cylindrical towards the end, the margins set with rather distant, large, sharp, slightly forward-pointing, triangular prickles orange red at the points, fewer and more distant towards the end of the leaf but the apex itself usually with several small ones, colour rather dull green spotted with yellow, the spots very numerous and roundish beneath and on the sheaths, fewer and more elongated on the upper surface. Flowering stem about 2 feet long, smooth, purplish green, pedicels about $\frac{3}{4}$ inch long, at first spreading afterwards erect, slender, yellowish; bracts membranous, ovate, much attenuated, about half as long as the pedicels; flowers crowded in a spicate raceme about 6 inches long, drooping when expanded. Perianth about $1\frac{1}{4}$ inches long, tubular but slightly campanulate in the upper part, segments oblong- or linear-spathulate, with prominent midribs, nearly equal, the 3 outer ones slightly longer but somewhat reflexed, thin, acute, pale yellow, the 3 inner erect, concave, rather broader, obtuse, bright-orange yellow; the buds orange-red, shining, their

points and midribs green. Stamens slightly exserted, scarcely connected with the base of the perianth. Style rather longer than the stamens. The rest as in the other species.

Habitat.—This species is a native of South Africa, but very little seems to be known of it as a wild plant. The younger Linnæus shortly defined and named it in 1781 from specimens collected by Thunberg, who discovered it during his journeys at the Cape in 1771-4, and afterwards gave a full description of it in 1785. Thunberg probably found it in the northern districts of the Cape Colony towards Namaqua-land, for Mr. Thos. Cooper, who collected in the eastern and western districts of the old Colony, the Orange-River Free State, Basuto-land, and Natal, tells us that he never met with the species.

The cultivated plant which we have figured and described differs, it must be allowed, in several particulars from Thunberg's description, but we are assured by Mr. Baker, who has studied the group, that it is referable to *A. spicata*. The plant is to be seen in cultivation at Kew and the Botanic Society's Garden. According to Haworth it was introduced in 1795, but has been always rare; Salm-Dyck states that he never saw it. The flowering stem is sometimes branched or forked.

Thunberg says that *A. spicata* affords by far the best aloes, but it is doubtful whether any is now obtained from this species. Several others are employed, of which *A. ferox*, Mill., is certainly one. This is a large species with the leaves prickly on the surface as well as the margins. It is figured in Bot. Mag., t. 1975; DC., Plantes Grasses, t. 32; and Salm-Dyck, Aloe, § 27, fig. 5; and grows in the Swellendam district of the Cape Colony. Other species which afford the drug in South Africa are:—*Aloe Commelini*, Willd. (*A. mitræformis*, DC.), figured in Bot. Mag., t. 1270; *A. arborescens*, Mill. (Bot. Mag., t. 1306); *A. africana*, Mill. (Bot. Mag., t. 2517); *A. plicatilis*, Mill., a singular species with blunt, tongue-shaped, crowded, distichous leaves; *A. linguæformis*, DC. (*A. sulcata*, Salm-Dyck, Bot. Mag., t. 1322; and there are doubtless others.

It will be evident from this and the preceding article that the

botany of the drug-yielding species of *Aloe* is in a very unsatisfactory state, and much needs more accurate investigation.

Thunberg, Dissert. Bot. Med. de Aloe (1785), p. 4; Haworth, Syn. Plant. Succ., p. 76; Kunth, Enum. Plant., iv, p. 530; Lindl., Fl. Med., p. 595; Flück. & Hanb., Pharmacogr., p. 617; Pappe, Fl. Cap. Med. Prod., ed. 3, p. 41.

Official Part and Names.—Aloe Capensis; the inspissated juice of the leaves of Aloe spicata, Thunberg, and of other species of Aloe, (U. S. P.). Cape aloes is not official in the British Pharmacopœia, or in the Pharmacopœia of India. But Aloe spicata, *D.C.*, was formerly recognised as the botanical source of Socotrine Aloes in the London Pharmacopœia; and Aloe spicata, *Persoon*, as the source of the same kind of aloes in the Dublin Pharmacopœia. Aloe Capensis is the Aloe lucida of Geiger, and some other pharmacologists. The two official varieties of aloes of the British Pharmacopœia, and the Pharmacopœia of India, are described by us under Aloe vulgaris, *Lamarck*, and Aloe succotrina, *Lam.* In Tuson's Veterinary Pharmacopœia, Aloe Barbadensis and Aloe Capensis are the two kinds of aloes recognised.

Collection and Commerce.—The mode of collection and preparation of Cape aloes, as witnessed by Mr. Lyell, a surgeon at Newburgh, in 1845, and communicated to Sir Robert Christison; and also by Hallbeck, a Moravian missionary, who resided at the Cape, may be described as follows:—The juice is collected in September and October by spreading sheep skins, with their smooth sides upwards, in hemispherical holes dug in the ground; and so arranging the leaves, which are cut off near the stem, around the hole, that the juice which runs out may be received into the skins. The leaves are removed when the juice has drained from them; and when the skins are full they are properly secured, and the juice is carried home, and subsequently inspissated by artificial heat in iron cauldrons, care being taken to prevent its burning, by constant stirring. When sufficiently concentrated, it is finally poured into boxes and skins, and allowed to concrete by cooling. Cape aloes is often much injured from want of care in conducting the evaporation; and from not separating from the juice earthy matters and

other impurities. The finest kind, which is collected at the Missionary Institution at Bethelsdorp, and hence termed *Bethelsdorp Aloes*, owes its superiority to the great care taken in its preparation.

Cape aloes is exported from the Cape of Good Hope in very large quantity, thus, in some years, exceeding 4000 cwt. The drug is shipped from Algoa Bay, Cape Town, and Mossel Bay. The fine kind known as Bethelsdorp Aloes is imported from Algoa Bay.

General Characters and Composition.—Different specimens of Cape aloes vary in their colour, the greater or less brilliancy of their fracture, the tint of their powder, and in other particulars, hence the varieties distinguished by Pereira, under the names of *Socotrine Cape Aloes*, and *Hepatic Cape Aloes*. As a general rule, the more characteristic peculiarities of Cape aloes are its brilliant, shining, conchoidal, almost vitreous fracture; and its peculiar odour. Usually it has a deep brown colour, with a greenish tint by reflected light; a smooth, conchoidal, glassy fracture; and, if held up to the light, it is translucent at the edges. When small fragments or splinters are viewed by transmitted light, they are transparent, and have a yellowish-brown or yellowish-red colour. It is very brittle, and, therefore, is easily pulverised, except in very hot weather, and the powder has a fine greenish-yellow or pale tawny-yellow colour. No crystals can be detected by the microscope in this aloes when moistened, as is the case under like circumstances with Barbadoes and Socotrine Aloes. Its odour is strong and disagreeable, more especially when broken and breathed upon; it is described as being sourish, and easily distinguishable from that of other kinds of aloes.

The constituents of this and other kinds of aloes are fully described under "Aloe succotrina."

Natal Aloes.—Besides the ordinary Cape Aloes, another variety of aloes is also now imported in large quantity from Natal, and hence termed *Natal Aloes*. Nothing is known of its botanical source beyond the fact that it is produced by a large species of *Aloe*.

Collection and Preparation.—It is prepared in the upper dis-

tricts of Natal, by British and Dutch settlers, by a process closely resembling that by which Cape Aloes is obtained. Thus, as communicated to the authors of Pharmacographia by Mr. Akerman, of Pietermaritzburg, it is as follows:—"The leaves are cut obliquely into slices, and allowed to exude their juice in the hot sunshine. The juice is then boiled down in iron pots, some care being taken to prevent burning, by stirring the liquid as it becomes thick. The drug while still hot, is poured into wooden cases, in which it is shipped to Europe."

General Characters and Composition.—Natal Aloes is entirely different in appearance from ordinary Cape Aloes, being greyish-brown in colour and very opaque; hence it belongs to the hepatic kinds of aloes. In its odour is resembles Cape Aloes more than any other variety of aloes.

Its composition is closely analogous to the other varieties of aloes which we have described under "Aloe succotrina." As there noticed, however, it contains a peculiar kind of aloin, termed *nataloin,* which is less soluble than barbaloin, and has other distinguishable characteristics from both socaloin and barbaloin.

Other Varieties of Aloes.—Besides the three official varieties of aloes known as Barbadoes Aloes, Socotrine Aloes, and Cape Aloes, which have been now described; and the non-official variety just noticed under the name of Natal Aloes; other varieties of Aloes, such as Curaçoa, Indian, Aden or Black Aloes, &c., have been described by pharmacologists, but these need no description in this work.

Medical Properties and Uses.—The medical properties and uses of aloes are given under "Aloe succotrina."

Christison, Dispensatory, p. 86; Per. Mat. Med., vol. ii, pt. 1, pp. 185 & 191; Pharmacographia, p. 622; U. S. Disp., by W. & B., p. 90; Tuson, Veterinary Pharmacopœia, p. 29.

DESCRIPTION OF PLATE.

Drawn from a specimen in Mr. Peacock's collection at the Royal Gardens, Kew, May, 1879. 1. A raceme of flowers. 2. A flower. 3. Perianth laid open. 4. Stamens and pistil. 5. Extremity of a young leaf. 6. Whole plant (reduced).

D Blair F.L.S. ad nat. del. et lith.

VERATRUM ALBUM, *Linn.*

M & N Hanhart imp.

N. Ord. MELANTHACEÆ. Lindl., Veg. Kingd, p. 198; Le Maout & Dec., p. 849.

Tribe *Veratreæ*.

Genus **Veratrum**,* *Linn.* Kunth, Enum. Plant., iv, p. 185. There are 6 to 8 species, natives of the temperate and cold parts of the northern hemisphere.

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285. Veratrum album, *Linn., Sp. Plant., ed.* 1, *p.* 1044 (1753).

White Hellebore.

Syn.—V. Lobelianum, *Bernh.* V. californicum, *Durand.*

Figures.—Woodville, t. 257; Nees, tt. 46, 47; Steph. & Ch., t. 136; Hayne, xiii, t. 26; Berg & Sch., t. 17 c; Jacquin, Fl. Austr., t. 335; Reichenb., Ic. Fl. Germ., x, tt. 937, 938; Redouté, Lil., t. 447.

Description.—A large perennial herb, with a short fleshy root-stock about $\frac{3}{4}$ inch in diameter, black outside, white within, giving off numerous long, thick roots from its sides, and clothed at the top with the fibrous remains of the old leaves. Flowering stem about 4 feet high, stout, cylindrical, solid, finely pilose or nearly smooth, pale green, unbranched except in the inflorescence. Leaves large, rather closely placed, alternate, 3-ranked, spreading, sessile and forming close overlapping smooth sheaths round the stem, 5—8 inches long, broadly oval, becoming gradually narrower up the stem, the upper ones lanceolate, passing into bracts, tapering to the subacute apex, entire, smooth above and dark green, very finely pilose and paler beneath, ribbed with several (10—15) strong veins from base to apex, and plaited along their course. Flowers very numerous, polygamous (bisexual and male), of moderate size, nearly sessile or shortly stalked, each in the axil of a small, short, ovate, acute, transparent bract, rather densely arranged, solitarily or in pairs, on the short stiff ascending branches (each subtended by a large bract) of the large, narrowly pyramidal, tapering inflorescence which is $1\frac{1}{4}$—2 feet long, with a long terminal spike, pedicels stout, pubescent. Perianth about $\frac{5}{8}$

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* *Veratrum*, the classical Latin name probably for this species.

or ¾ inch across, persistent, very deeply divided into six almost separate, spreading, ovate, subacute or obtuse segments, narrowed below, often slightly denticulate, pubescent outside, pale greenish-yellow, with dark green veins and base, the inner three often slightly longer. Stamens 6, inserted at the very base of the perianth-segments and shorter than them, filaments stout, curved outwards above, glabrous, anthers small, squarish, dehiscing transversely, extrorse. Carpels 3 (often abortive and then reduced to small tapering bodies, much shorter than the stamens or quite absent), the ovaries slightly connected in the centre, with numerous ovules in two rows, tapering into the quite distinct curved styles, stigmas hooked, blunt. Fruit of 3 acute, nearly-distinct follicles, about 1 inch long, pericarp dry, chartaceous, brown, dehiscing from above along the ventral sutures. Seeds about a dozen in each carpel, small, surrounded by an unequal membranous wing, obliquely ovate-oblong, pale brown, embryo small, straight, included in the base of the fleshy endosperm.

Habitat.—This is an Alpine and sub-Alpine species in Central and Southern Europe, and is common in all the great mountain regions, as the Pyrenees, the Alps, and the Balkans, growing in moist grassy places, as well as in the lower hills of Portugal, France, Italy, Germany, &c., but it does not occur in the British Isles. In the east of Europe it is spread over a great part of Russia, ranging to a high latitude, and even extending into eastern Lapland. The form which more frequently occurs there is var. *viridiflorum,* Kunth (*V. Lobelianum,* Bernh.), which is found in several parts of Europe, and also extends over a large area in Siberia, passing into the Arctic regions, and occurring in Nova Zemlia. It differs from the type chiefly in its bright green flowers, and appears to connect it with the next, *V. viride* Sol. The plant called *V. album* in North America is considered distinct by S. Watson, and is *V. californicum,* Dur. It occurs in the Western States, Colorado, N. California, and Oregon.

V. album was grown in England by Gerard before 1596, and is to be seen in all botanic gardens. It flowers in July, but neither

in cultivation nor wild do the plants flower with regularity. The appearance of the blossoms is singular, and the plant has a distinct faint alliaceous odour.

Grenier & Godr., Fl. France, iii, p. 172; Ledebour, Fl. Ross., iv, p. 208; Parlatore, Fl. Ital., iii, p. 204; Kunth, Enum. Plant., iv, p. 186; Lindl., Fl. Med., p. 585.

Official Part and Name.—VERATRUM ALBUM; the rhizome (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India; but it was formerly recognised in the London, Edinburgh, and Dublin Pharmacopœias.

General Characters and Commerce.—White Hellebore, White Hellebore Rhizome, or White Hellebore Root, by all of which names it is known, is seen in commerce in cylindrical or subconical pieces, which are from two to three inches long, or very rarely more, and about one inch in diameter. The rhizome is frequently broken at the lower end, or cut transversely in order to facilitate its drying. At its upper extremity it is often branched, and is then sometimes described as two- or more-headed; when unbranched it is said to be single-headed; each of these heads is frequently crowned by the remains of the dried leaves arranged concentrically one over the other. Externally it has a blackish or greyish-brown colour, and is more or less wrinkled and rough, especially at its lower extremity, with the scars and pits of old roots, while portions of the recent roots may be usually found attached at its upper end; and rarely the rhizome is nearly covered with roots. A transverse section presents a large central woody or spongy portion of a whitish or pale buff colour, separated by a fine wavy-crenate ring from an outer broad white part, which is coated by a thin dark brown or blackish portion. A vertical section also shows a fine dark wavy conically arranged line running nearly throughout its whole length, and thus separating the outer and central portions. When sulphuric acid is added to a transverse or vertical section, a deep orange yellowish-red colour is at once produced from its action on the constituent alkaloids; but this colour soon changes to a dark blood-red. In a fresh state the rhizome

has an alliaceous odour, but when dried it has no marked smell; if in powder, however, or when it is cut or bruised, it excites sneezing. Its taste is at first sweet, then bitter and acrid, and subsequently leaving a sensation of tingling and numbness on the tongue. White hellebore deteriorates by keeping.

White hellebore is imported from Germany in bales, and two kinds are commonly distinguished in commerce under the names of Swiss and Austrian. Generally, also, from the almost entire absence of roots, the rhizome is described as *without fibre;* when otherwise, it is stated to be *with fibre.*

Composition.—White hellebore appears to contain several bases, the more important of which are probably *veratria* which is described in our notice of *Schœnocaulon officinale;* and a peculiar alkaloid called *jervia* or *jervine.* According to the observations of Dragendorff, however, the veratria of cevadilla cannot be obtained from white hellebore. More recently again, T. G. Wormley finds as the result of repeated experiments, that white hellebore "contains an alkaloid, which, when pure, in its behaviour with the mineral acids and with liquid precipitants, fully responds in all the reactions of veratria or veratrin." The recent experiments of C. R. A. Wright and A. P. Luff indicate the presence of the following bases, namely, *jervine, pseudojervine, rubijervine, veratralbine,* and *veratrine.* These are also alluded to in our notice of *Veratrum viride;* but for further details on the constituents of white hellebore, as also the source of its medicinal activity, we must refer to the papers and authors mentioned at the end of this article.

Medical Properties and Uses.—When taken internally white hellebore acts as a powerful emetic and purgative; and in excessive doses as a narcotico-acrid poison. Locally applied it is a powerful irritant to the skin; and under the same circumstances, when brought into contact with the mucous membrane of the nose, it produces violent sneezing. It is rarely or ever employed in this country at the present time internally, and but to a trifling extent in the United States, on account of the severity of its action. But it was formerly in use in cerebral affections, as mania,

epilepsy &c.; and as a remedy in gout instead of colchicum. In the latter disease, however, Garrod states, that "he is sure that its action differs completely from that of colchicum."

Externally it is occasionally employed in the form of ointment or decoction in obstinate skin diseases, as scabies, &c.; and to destroy pediculi. It is also sometimes used as an errhine or sternutatory, when diluted with some mild powder as starch, in cases of amaurosis and chronic affections of the brain.

The principal consumption of this drug is, however, in veterinary medicine.

Per. Mat. Med., vol. ii, pt. 1, p. 169; Pharmacographia, p. 630; U. S. Disp., by W. & B., p. 885; Tuson, Veterinary Pharmacopœia, p. 288; Garrod, Mat. Med., p. 382; Bentley, in Pharm. Journ., vol. vii, ser. 3, p. 649; Proc. Amer. Pharm. Assoc., vol. xxiv (1876), p. 356; Tobein, in Year Book of Pharmacy (1878), p. 132, and Amer. Journ. Pharm. (1878), p. 122; Wright & Luff, in Pharm. Journ., vol. ix, ser. 3, p. 985.

DESCRIPTION OF PLATE.

Drawn from a plant cultivated in Kew Gardens; the fruit added from a Californian specimen in the British Museum.

1. Portion of the inflorescence.
2. A bisexual flower.
3. Vertical section of a male flower.
4. A fruit.
5. A seed.
7. A flowering plant, $\frac{1}{8}$ nat. size.

(5 enlarged.)

D.Blair F.L.S. ad nat. del. et lith.

VERATRUM VIRIDE, *Soland.*

M & N. Hanhart imp.

N. Ord. MELANTHACEÆ.

Tribe *Veratreæ*.

Genus **Veratrum**, *Linn.*

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286. Veratrum viride, *Solander in Ait. Hort. Kew., iii, p.* 422 (1789).

American White Hellebore. Indian Poke.

Syn.—V. album, var., *Regel & others.* Helonias viride, *Ker?* V. Eschscholtzii, *Gray.* V. parviflorum, *Bong.* non *Mich.*

Figures.—Bigelow, ii, t. 33; Bot. Mag., t. 1096?.

Description.—A large perennial herb with a rhizome similar to that of *V. album.* Stem 2—7 feet high, much as in the last. Leaves similar in arrangement, but usually narrower and more acuminate, the upper ones especially. Flowers on rather longer pedicels and more laxly arranged to form a tapering panicle with slender drooping branches, bracts as long as the flowers, often leafy. Perianth-segments narrower than in *V. album* and more spreading, narrowly lanceolate-obovate, greenish with a darker base. Capsule rather shorter than in the last, slightly adnate to the perianth at the base.

Habitat.—This is a marsh plant growing in swamps in many parts of the North United States, Canada, and Alaska. It is by many botanists combined with the last, *V. album,* L., to which it is without doubt closely allied. S. Watson, however, maintains it as a distinct species and gives several distinguishing characters. Our plate is drawn from one of the original type-specimens; the figure of *Helonias viride* in the Bot. Mag. must be doubtfully quoted, as it seems to represent merely *V. album.*

V. viride was grown in England in 1763, and a plant so called is still found in several of our botanic gardens, which differs from *V. album* only in its smaller size, and narrower and more plicate leaves.

Kunth, Enum. Plant., iv, p. 188; A. Gray, Man. Bot. U. States p. 525; S. Watson, in Proc. Amer. Acad., xiv, p. 277; Lindl. Fl. Med., p. 585.

Official Part and Names.—Veratri Viridis Radix; the dried rhizome (B. P.). The rhizome (I. P.). Veratrum Viride; the rhizome (U. S. P.). It is also termed in the British Pharmacopœia and in the Pharmacopœia of India, *Green Hellebore Root;* and in the Pharmacopœia of the United States, *American Hellebore.* It should be carefully distinguished from *Helleborus viridis,* a plant of the order Ranunculaceæ, to which the name of Green Hellebore more properly belongs. American Hellebore is also known by the names of Indian Poke, Poke Root, and Swamp Hellebore.

Collection.—American Hellebore is collected in the United States and Canada, in the autumn; and the rhizome is then either dried entire, or after having been sliced in different ways.

General Characters.—American Hellebore generally occurs in commerce in transverse or longitudinally cut slices, and either with or without attached roots; or the rhizome entire; or, in rare cases, the roots and rhizome are compressed together into rectangular cakes of about one inch in thickness. In some specimens, portions of the dried bases of the leaves concentrically arranged remain attached to the rhizome, but as these have been ascertained by Procter to be inert, they should be rejected.

When entire, the rhizome is from one to two inches in length, and about three quarters of an inch in diameter at its broadest part, and then tapering to an obtuse or truncated point; its colour externally is dark brown, and whitish or yellowish white internally; it has a somewhat compact texture. The roots, which are numerous, are either attached to the rhizome, or loose and mixed with it; in the latter case the rhizome is marked with the scars left by their breaking off. These roots vary in length, but are frequently several inches, about the thickness ordinarily of a knitting needle, much shrivelled in appearance from contraction in drying, of a yellowish colour, and closely marked by little depressions on their surface. Neither the roots or rhizome have any marked odour; but they have an acrid, bitter taste.

Composition.—American hellebore has been frequently analysed, and with somewhat conflicting results; but all analyses seem to

prove that it contains *veratria*, or an alkaloid closely identical with it. Like white hellebore, it also contains the alkaloid *jervia* or *jervine*. In 1865, Bullock described two alkaloids as constituents, one soluble in ether, and the other insoluble, and neither of which he believed was identical with veratria; to these the names of *veratroidia* and *viridia* were afterwards given by Wood. Subsequently, however, in 1876, Bullock repeated his experiments, and then concluded that jervia was the only alkaloid in American hellebore, and that the so-called veratroidia was only a mixture of jervia with a light coloured resin. Robbins, in 1877, found as a constituent an alkaloid which he regarded as distinct from veratria, jervia, and veratroidia, and which he named *veratridia*, and to which he attributed in a great measure the activity of this drug. Wormley finds, as alluded to in our article on *Veratrum album*, that American hellebore contains, like it, an alkaloid which when pure, fully responds in its behaviour with the mineral acids and liquid precipitants to all the reactions of veratria. Wright and Luff have recently described no less than six distinct bases in this drug, which they have named Jervine, Pseudojervine, Rubijervine, Veratralbine, Veratrine, and Cevadine. All these principles, except Cevadine, they also found in white hellebore; the main differences between the two drugs being the much larger yield of bases from veratrum album. At present nothing of a very definite nature can be stated as to the source of the medicinal activity of American hellebore.

Medical Properties and Uses.—The action of this drug appears to be identical, or very analogous, to that of white hellebore; but it is said to differ from the latter by not producing purging. It should be used with great caution as it frequently causes very distressing nausea and extreme depressing effects on the circulation and nervous system. Harley describes it as "irritant and sedative like colchicum, which it also closely resembles in action; but it is less irritant and more directly sedative, so that it may be said to occupy a position intermediate between colchicum and digitalis." In the United States it has been highly spoken of as a remedy in pneumonia, gout, rheumatism,

typhoid fever, and various other affections; but at present little value is attached to its use by practitioners in this country. By some physicians, however, it is regarded as useful in fever, more especially rheumatic fever, and in acute local inflammations; but its value therapeutically requires and deserves a more careful investigation than it has hitherto received.

Per. Mat. Med., by B. & R., p. 426; U. S. Disp., by W. & B., p. 886; Pharmacographia, p. 632; Royle, Mat. Med., by J. Harley, p. 390; Scattergood, in Proc. Amer. Pharm. Assoc., vol. x (1862), p. 222; Bullock, in Amer. Jl. of Pharmacy, vol. xxxvii, p. 325, & Proc. Amer. Ph. Assoc., vol. xv (1867), p. 360, & vol. xxiv (1876), p. 363; Year Book of Pharmacy (1874), p. 102; Wormley, in Proc. Amer. Pharm. Assoc., vol. xxiv (1876), p. 356; Robbins, in Proc. Amer. Pharm. Assoc., pp. 439 & 523; Cutter, in Pharm. Journ. ser. 2, vol. iv, p. 134; Wright & Luff, in Pharm. Jl., vol. ix, ser. 3, p. 986; Bullock, in Pharm. Journ., vol. x, ser. 3, p. 186, from Amer. Journ. Pharm., July, 1879.

DESCRIPTION OF PLATE.

Drawn from a North American specimen in the British Museum herbarium.

1. Upper part of the inflorescence.
2. Vertical section of a male flower.
3. A single segment.
4. A leaf.

D. Blair ad sicc. del: et lith.

M & N. Hanhart imp.

SCHŒNOCAULON OFFICINALE, *A. Gray*

N. Ord. MELANTHACEÆ.

Tribe *Veratreæ*.

Genus Schœnocaulon,* *A. Gray*. Species 3, all found in southern North America.

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287. Schœnocaulon officinale, *A. Gray in Benth. Plant. Hartweg., p.* 29 (1839).

Sabadilla. Cevadilla.

Syn.—Melanthium Sabadilla, *Thunb.* Veratrum officinale, *Schlecht.* Helonias officinalis, *Don.* Sabadilla officinarum, *Brandt.* Asagræa† officinalis, *Lindl.*

Figures.—Nees, Supp.; Hayne, xiii, t. 27; Berg & Sch., t. 9 e; Bot. Reg., xxv (1839), t. 33.

Description.—A bulbous herb, the small ovoid bulb covered with numerous thin, black scales, and the scape reaching 5 feet or more in height. Leaves all from the bulb, linear, grass-like, 1½—4 feet long, smooth, entire, gradually tapering, keeled with a strong midrib. Scape slender, cylindrical, or somewhat angular, smooth, quite simple. Inflorescence a moderately dense, very narrow, spike-like raceme, 9—18 inches long, pedicels short, with small bracts at the base, flowers very numerous, scarcely ⅜ inch wide, those in the lower part of the inflorescence hermaphrodite, those in the upper part staminate and sterile. Perianth-leaves 6, spreading in two whorls, the outer 3 slightly larger, strap-shaped, blunt, thick, greenish-yellow, hollowed and nectariferous at the base. Stamens 6, hypogynous, opposite the leaves of the perianth and longer than them, very slightly adherent to their base, filaments flat, anthers large, reniform, yellow, the cells confluent, dehiscing along the top. Carpels 3, superior, erect, shorter than the stamens, in contact by their ventral sutures, each with several (6—8) ascending ovules, styles slender, slightly combined at the base, curved

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* Name from σχοῖνος, a rush, and καυλός, a stem, from the habit of its scape.

† *Asagræa* was given in commemoration of Prof. Asa Gray, of Harvard University, the most distinguished of living American botanists.

outwards; in the barren flowers the carpels are rudimentary. Fruit composed of three dry follicles about ½ inch long, surrounded at the base by the withered perianth and slightly spreading at the top; pericarp pale brown, papery, dehiscing down the ventral suture. Seeds (often abortive) 2—5 in each follicle, dark brown, fusiform, somewhat compressed, prolonged above into a membranous wing; embryo very small, immersed in copious endosperm at the base near the hilum.

Habitat.—The Sabadilla is found in grassy places on open hills in Mexico, Guatemala, and Venezuela. The plant found in the neighbourhood of Caracas has somewhat broader and more distinctly carinate leaves, but can scarcely be held to constitute a different species. *Sabadilla* and *Schœnocaulon* differ only in the former having polygamous flowers, and the two genera may be, therefore, combined with propriety. The date of both names is 1837 (the latter genus having been founded on *S. gracile*), so that we are free to adopt either.

Veratrum Sabadilla, Retzius, Obs. Bot., i, p. 31 (1779), is also a source of Sabadilla, having been originally described from a raceme of flowers picked out from among the drug. They were polygamous, with purplish-black, ovate perianth leaves. Descourtilz gives a full description of a West Indian plant under the same name with a figure which is reproduced in Nees, t. 48, and represents a true *Veratrum*. Mr. Baker is inclined to refer it to the common European *V. nigrum*, L. The plant, however, is not known in our herbaria (see Roem. and Schultes' Syst., vii, p. 1558, Lindl. Fl. Med., p. 586, Kunth, Enum. iv, p. 188, Flück. and Hanb., Pharmac., p. 634, note).

Kunth, Enum. Plant, iv, p. 184; Ernst, in Journ. Bot., ix, p. 91; Lindl., Fl. Med., p. 586.

Official Parts and Names.—Sabadilla; the dried fruit of Asagræa officinalis, *Lindl.* (B. P.). The seeds (*Sabadillæ Semina*) of Asagræa officinalis (I. P.). Sabadilla; the seeds of Veratrum Sabadilla, *Retzius*, (U. S. P.).

Commerce, General Characters, and Composition. — It seems probable that the Sabadilla, Cevadilla, or Cebadilla of commerce,

may be obtained from more than one plant. The dried fruit was formerly alone imported from Vera Cruz, being the produce of plants cultivated in Mexico; but of late years, as stated by Ernst, the seeds are now alone shipped in large quantities from La Guayra, the port of Caracas.

Each fruit, as found in commerce, is about half an inch long, and is surrounded at its base by the remains of the perianth, and attached to a short stalk; it consists of three light brown, oblong, pointed carpels (*follicles*), of a papery texture. The carpels are united at their base, but separated above, and open on their inner or ventral suture. Each carpel contains from one to three or more seeds, usually two, which are about $\frac{3}{10}$ of an inch in length, narrow, pointed, somewhat scimitar-shaped and winged, shining, corrugated, of a blackish-brown colour, an acrid bitter taste, and without odour, but when powdered producing violent sneezing. In commercial specimens the carpels are frequently found without any contained seeds, these having fallen out, and may be seen lying in a loose state mixed with the empty carpels.

Cevadilla owes its properties essentially to the alkaloid *veratria*, but it is still doubtful whether this alkaloid is confined to the seeds, or whether it is likewise contained in the pericarp. Veratria is said to be combined with gallic acid. As seen in commerce, and used in medicine, veratria is always in an amorphous powder, but when pure it is in long acicular crystals. Veratria in a pure state is nearly insoluble in water, but readily soluble in alcohol, ether, and chloroform. It has no odour, but if inhaled it produces violent sneezing; its taste is persistently and strongly bitter, and highly acrid.

Two other alkaloids have been also discovered in Sabadilla, one crystallizable and called *sabadilline*, and the other uncrystallizable, and to which the name of *sabatrine* has been given. The former is always present in commercial veratria; it may be distinguished from it by being insoluble in ether, and by not causing sneezing. Sabatrine is also said to be contained in the veratria of commerce.

Medical Properties and Uses.—Cevadilla can scarcely be said to be in use at the present time in itself as a medicinal agent, although

it was formerly employed internally as an anthelmintic, and in rheumatic and neuralgic affections; and externally for destroying pediculi. It is official in the pharmacopœias as the source of veratria, which is of a highly poisonous nature, but it has been employed in very minute doses internally in acute rheumatism and gout; as an antiphlogistic in some inflammatory diseases; and in other cases; but it is a very dangerous remedy for internal use. For external application, however, in the form of an ointment, veratria has been found very useful in rheumatism, neuralgia, and other painful affections, but it is not generally regarded as so valuable as aconitia when used in the same form, and in like cases. The ointment is also employed for the destruction of pediculi.

Per. Mat. Med., by B. & R., p. 422; Pharmacographia, p. 633; U. S. Disp., by W. & B., pp. 750 and 1497; Garr., Mat. Med., p. 384; Wigger's and Husemann's Jahresbericht for 1871, p. 24; Journ. de Pharm., vol. xiv, p. 527; Amer. Journ. of Pharm., vol. xxv, p. 133.

DESCRIPTION OF PLATE.

Drawn from a specimen collected by Ernst in Venezuela (no. 219), in the British Museum. The fruit added from the commercial drug.

1. A sterile flower.
2. Anthers.
3. A fertile hermaphrodite flower.
4. Perianth segments.
5. Transverse section of ovaries.
6. Vertical section of a carpel.
7. Part of raceme of fruit.
8. A single fruit.
9. Seed.
10. Section of the same.

(1–6, 9, 10 enlarged.)

D Blair F.L.S ad nat. del. et lith.

M&N.Hanhart imp.

COLCHICUM AUTUMNALE, *Linn.*

N. Ord. MELANTHACEÆ.

Tribe *Colchiceæ.*

Genus Colchicum,* *Linn.* Kunth, Enum. Pl., iv, 138—145. Over 20 species are known, natives chiefly of the Mediterranean district.

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288. Colchicum autumnale, *Linn., Sp. Plant., ed.* 1, *p.* 341 (1753).

Meadow Saffron. Wild Saffron.

Figures.—Woodville, t. 258; Hayne, v, t. 45; Steph. & Ch., t. 70; Nees, t. 49; Berg & Sch., t. 12 a; Syme, E. Bot., ix, t. 1544; Leighton, Fl. Shropshire; Reichenb., Ic. Fl. Germ., x, t. 426; Redouté, Lil., t. 228.

Description.—A perennial herb, with a short, solid, subterranean, bulb-like stem (corm), with a tuft of filiform roots beneath and covered with a bright brown papery coat with a darker one outside. Corm (in autumn) irregularly pear-shaped, oblique at the base, about 2 inches long by 1 to 1½ in diameter, tapering upward, crowned with the withered remains of the foliage or with a hollow scar, rounded on one surface, flattened on the other to which is attached, at the base, the very small new corm from which the flower arises. Leaves 3—5, strongly sheathing, closely-placed on the short axis, 6—12 inches long, erect, oval-strap-shaped, entire, smooth, somewhat shining, dark green, appearing in spring and withering before autumn. Flowers very large, solitary or 2 or 3, erect, terminating the short axis and appearing before the leaves (in the previous autumn), tube very long, 6 or 7 inches, the lower part surrounded by a sheathing white spathe-like bract and in contact with the flat side of the previous season's corm within the coats of which it is included, thick but weak, bluntly trigonous, white below, pale reddish-lilac above, segments 6 in two rows, 1½ to 2 inches long, the inner a little smaller, erect-spreading, oblong-oval, concave, blunt, reddish-lilac, faintly mottled and with a paler midrib.

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* *Colchicum,* in Greek κολχικόν, native to Colchis, the classical name.

Stamens 6, inserted in the mouth of the perianth-tube, at the base of the segments and much shorter than them; anthers oblong-linear, dorsifixed with the filaments at first towards the centre of the flower, afterwards versatile, 2-celled, bursting laterally, yellow. Carpels 3, ovaries slightly united to form a single very deeply-divided 3-celled superior ovary, which is at the bottom of the perianth-tube and subterranean, ovules numerous in 4 rows on a double placenta in each cell; styles 3, wholly distinct, passing up the whole length of the perianth-tube and exceeding the stamens, the exposed portions purple, with a recurved tip covered with the stigmatic papillæ which run for a little distance down the inner surface. Fruit of 3 inflated follicles, slightly connected at the base, $1\frac{1}{2}$ inch long or more, slightly stalked, convex on the back, acute at the top, pericarp very thin and papery, slightly rugose, pale brown, dehiscing along the ventral suture. Seeds numerous, small, about $\frac{1}{8}$ inch in diameter, sub-globular with a thickened short funicle, testa thick, rugose, brown, embryo minute, without cotyledons, placed at the side in the copious endosperm.

Habitat.—This is a somewhat local plant in England, growing in meadows in most of the counties, but common in only a few of them; it is an introduced plant into Scotland. Its entire range extends through middle and southern Europe to the Mediterranean, Greece, Turkey, and the Crimea. In the Alps of Switzerland it ascends to 5500 feet.

The handsome crocus-like flowers appear above ground at the end of September and beginning of October, and wither away after fertilization has taken place. During the winter the ovary matures itself beneath the surface of the soil, and the corm which it terminates increases in size. In April, the half-ripe capsule with its surrounding tuft of leaves is pushed above ground, and by the end of June the seeds are ripe and the corm has attained its full size. The latter now produces a lateral bud or new rudimentary corm which is destined to pass through the same history, during which the former corm steadily decreases in size and ultimately decays away.

The term "extrorse" as applied to the anthers of *Colchicum* is liable to misapprehension. In the young state in the bud the filaments are attached to the anthers on the side towards the centre of the flower, and the latter are therefore on the outside, but they afterwards swing on the apex of the filaments (versatile) and even turn over to the inner side; the dehiscence is down the edge of the anther-cells.

Several varieties are described. A singular spring-flowering form (*C. vernum*, Schrank) with greenish-yellow flowers with very long segments is figured in Syme, E. Bot., t. 1545; the anthers were barren. This plant was obtained in Wiltshire.

Syme, E. Bot., ix, p. 225; Hook. f., Stud. Fl., p. 386; Watson, Comp. Cyb. Br., p. 338; Leighton, Fl. Shropshire, p. 156; Kunth, Enum. Plant., iv, p. 140; Roemer & Schultes, Syst. Veg., vii, p. 1512; Lindl., Fl. Med., p. 589; Flück. & Hanb., Pharmacogr., p. 636.

Official Parts and Names.—1. COLCHICI CORMUS; the fresh corm, collected about the end of June, and the same stripped of its coats, sliced transversely, and dried at a temperature not exceeding 150°:—2. COLCHICI SEMINA; the fully ripe seeds (B. P.). 1. The fresh corm, and the dried transverse slices:—2. the fully ripe seeds (I. P.). 1. COLCHICI RADIX; the corm:—2. COLCHICI SEMEN; the seed (U. S. P.).

1. COLCHICI CORMUS.—*Growth, Collection, Preservation, and Commerce.*—The new corm first appears on the side of the old one at its lower end about the end of June or beginning of July; it flowers in the autumn, and produces its leaves in the following spring, and its seeds in the June of the same year. It then begins to shrivel, becomes leathery, and finally disappears in the succeeding spring or summer. Hence it is biennial. The activity of the corm will, therefore, necessarily vary much according to the period at which it is collected. It is more commonly considered to be in the most active state for medicinal use when it is about a year old—that is, about the end of June or beginning of July, between the withering of the leaves and the sprouting forth of the flower of the young corm. At this period it is fully developed, and has

not exhausted itself by the production of the young corm; it is, therefore, now commonly dug up at this period in England, and is so directed to be collected in the British Pharmacopœia and the Pharmacopœia of India.

Some difference of opinion, however, exists upon this point. Thus Christison remarks, "The plumpness and proportion of starch are certainly greater in July when the bulb is twelve months old, than in the next April, when it is obviously spongy and more watery; but in the latter state it has appeared to me quite as bitter, if not even more so, than when plump and full of starch; and its bitterness is obviously a more probable measure of its activity than any other criterion derived from its sensible qualities." But few, if any, agree with the above opinion of Christison; but Professor Schroff, with, we believe, far more reason, states as the result of his experiments, that the corms are most active when collected in the autumn during or after the process of flowering. The experiments of Stoltze also prove the activity of the autumn corm. Corms gathered at this time are sometimes brought into the English market.

Colchicum corms are directed in the British Pharmacopœia to be used either in their fresh state, or when dried. If dried, they are usually cut into thin transverse slices; these are then exposed to a moderate heat, which according to the B. P. should not exceed 150°, and dried as quickly as possible; after which the membranes are removed by sifting or winnowing. In the British Pharmacopœia the membranes are directed to be removed before the corms are sliced, but in practice this is rarely done, and is unimportant. Dr. Houlton recommends that the corm should be dried entire after it has been stripped of its coats, and carefully deprived of the young corm forming on its side; and Professor Schroff also advocates the drying of the corm when entire, by exposure to the sun and air. If carefully dried, however, whether in a sliced or entire state, the activity of the corm is not sensibly impaired; and if well preserved is not injured by keeping. In the process of drying, according to Hanbury, the corm when sliced, loses about 70 per cent. of water; and others also state, that eight

pounds of the fresh corm yield about two pounds fifteen ounces of the dried.

The London markets are chiefly supplied from Gloucestershire, but some corms are also derived from Oxfordshire and Hampshire; and in some cases from Germany. The supply in the United States is also of English or German growth.

General Characters and Composition.—The fresh corm when gathered about one year old is somewhat conical in form, from $1\frac{1}{2}$ to 2 inches in length, and about 1 inch in width at its lower end; it is flattened on one side, namely, that on which the new corm is being formed, and rounded on the other; and is covered by an outer thin, brown, membranous coat, and an inner paler one, of a reddish-yellow colour. Internally, it is white, firm, fleshy, and homogeneous in appearance; and when cut it yields a milky juice of a bitter taste, and disagreeable odour. Colchicum corms somewhat resemble in size and appearance tulip bulbs, and these latter have occasionally been substituted for them in the London market. Tulip bulbs are, however, readily distinguished on being cut across, when they are seen to be composed, like other bulbs, of scales enclosing each other in a concentric manner; whereas colchicum corms are solid. Colchicum corm is improperly designated as a *root* in the Pharmacopœia of the United States; and it is also sometimes incorrectly termed a *bulb*.

The dried transverse slices of colchicum corm are usually about one-eighth or one-tenth of an inch in thickness, of a yellowish colour at their circumference, and moderately indented on one side, so that they are somewhat reniform in outline. The cut surfaces should present a firm, white, clean, amylaceous appearance; the slices are brittle, and have a bitter taste, but no marked odour. Those slices which are deeply notched, or which are mouldy or stained, are usually regarded as of inferior quality. The best test of colchicum corm is its taste. In the United States the corms are sometimes sliced vertically; these slices resemble the former in all particulars, except their shape.

The principal constituents of colchicum corm are *starch*, of

which it contains about 10 per cent.; and *colchicia*, which is its active constituent; it is described below under Colchici Semina. The fresh corm would also appear to contain some volatile principle upon which its disagreeable odour depends, as this is lost by drying.

It has also been recently shown by J. Pierre that colchicum flowers during or approaching the act of fecundation exert a peculiar toxic action, which he thinks is probably due to the presence of an extremely volatile substance.

2. Colchici Semina.—*Collection.*—Colchicum seeds should be collected when fully ripe, which is commonly about the end of July or beginning of August. Our supplies are obtained from the same districts as already noticed with reference to the corm.

General Characters and Composition.—Colchicum seeds are rounded in form, about the eighth of an inch in diameter, or nearly the size of white mustard seeds; their surface is somewhat rough, and when the seeds are fresh it is of a reddish-brown colour, but it becomes darker when the seeds are kept. Colchicum seeds are very hard, and when broken do not present an oily appearance; they are without odour, but have a bitter acrid taste. According to Schroff, their activity is inferior to that of the dried corm collected in autumn.

Colchicum seeds, like that of the corm, owe their activity to the presence of a peculiar principle, which has been variously termed *colchicia, colchicine,* or *colchicin,* according to the different views entertained as to its nature. Some recent experiments of Flückiger have led him to infer that a *second alkaloid may also exist in Colchicum seeds.* The proportion of colchicia is very small, thus in the seeds, which are more productive than the corm, it is said to amount to only about 0·05 per cent.; but Ottmar Eberbach obtained from different samples of seed from 12 to 15 grains in 16 ounces, making an average yield of 0·19 per cent. Chemists are not agreed as to the properties of colchicia; it has been variously described as an alkaloid, a neutral substance, and as a weak acid, but more generally as the former. Colchicia is usually obtained as an amorphous yellow substance, with an

intensely bitter taste, readily soluble in chloroform or alcohol, less so in ether, and slowly soluble in cold water. By treatment with acids a crystallizable body, called *colchiceïn*, may be obtained from amorphous colchicia. Eberbach has also succeeded in crystallizing colchicia out of very concentrated solutions in chloroform, in fine tufts of transparent silky needles. Colchicia is said not to excite sneezing like the closely allied alkaloid veratria. It is a very active poison. It has recently been stated by Herr Dannenberg and Herr Van Geldern, that there exists in beer a substance which resembles closely colchicia in its reactions; but which is destitute of its poisonous action.

Medical Properties and Uses.—The action of both colchicum seed and corm is the same, the difference being in degree only; the flowers also have similar properties. Colchicum acts as a stimulant on certain of the secreting organs, thus on the intestinal canal, by which it becomes cathartic and emetic; on the genito-urinary organs as a diuretic; and on the liver as a cholagogue. As a consequence of this action a sedative effect follows, by which the heart's action is diminished. In improper doses it acts as a powerful acro-narcotic poison. It is chiefly valued as a remedy in gout and in acute rheumatism, and in other inflammatory affections; in the former disease especially, its use is attended with such beneficial effects, that it has long been regarded as a specific. It is also often given with advantage in combination with other purgatives as a cholagogue, in cases of imperfect action of the liver. In dropsies and in obstinate skin diseases it has also been sometimes used with advantage. Colchicum has likewise been employed, but with doubtful benefit, in numerous other diseases, as hysteria, chorea, whooping-cough, chronic bronchitis, in the lithic or uric acid diathesis, obstinate constipation, gonorrhœa, especially for the prevention of chordee, and for the expulsion of tapeworm, &c.

Per. Mat. Med., vol. ii, pt. 1, p. 155; Per. Mat. Med., by B. and R., p. 417; Pharmacographia, p. 636; U. S. Disp., by W. and B., p. 320; Garr., Mat. Med., p. 386; Christison's Disp., p. 352; Wiggers, Jahresbericht der Pharm., 1856, p. 15; Amer.

Journ. Pharm., vol. xxix, p. 324; Carter, in Amer. Journ. Pharm., May, 1858, p. 209; Maisch, in Pharm. Journ., vol. ix, ser. 2, p. 249; Diehl, in Proc. Amer. Pharm. Assoc., 1867, p. 363; Eberbach, in Proc. Amer. Pharm. Assoc., vol. xxii, 1874, p. 453; Pierre, Comptes Rendus, vol. lxxix, p. 633, and Pharm. Journ., ser. 3, vol. v, p. 325; Flückiger, in Journ. Chem. Soc., Sept., 1876, from N. Repert. Pharm., No. 1, 1876, p. 18, and also in Proc. Amer. Pharm. Assoc., vol. xxiv, 1876, p. 364; Pharm. Journ., vol. vii, ser. 3, p. 351.

DESCRIPTION OF PLATE.

Drawn from a plant in Chelsea Garden, the leaves and capsule added from herbarium specimens.

1. A plant in flower.
2. Section of upper part of perianth.
3. Section of lower part of flower and of the corm.
4. Vertical, and—5. Transverse section of ovary.
6. Stigma.
7. Foliage and ripe fruit.
8. Transverse section of fruit.
9, 10. Seed.
11. Section of the same.

(4–6, 10, 11 enlarged.)

D.Blair F.L.S. ad nat. del. et lith

SMILAX

ALIS, *Kunth*.

M & N.Hanhart imp

N. Ord. Smilaceæ. Lindl. Veg. Kingd., p. 215. Le Maout & Dec., p. 854 (in part).

Genus **Smilax**,* *Linn.* A large genus of about 200 species, natives of tropical and warm temperate regions in both hemispheres.

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289. Smilax officinalis, *Kunth, in Humb. & Bonpl. Nov. Gen. et Sp.* i, *p.* 271 (1815).

Jamaica Sarsaparilla.

Not previously figured.

Description.—A very large perennial climber. Rhizome subterranean, large, short, knotted with thickened nodes whence are given off very numerous, closely placed roots spreading horizontally, reaching a length of 6—8 feet, cylindrical, somewhat thickened about their middle portion, slightly wrinkled longitudinally, pale brown, unbranched above, but with numerous small rootlets in the lower part. Stems numerous, semi-woody, erect at the base, where they are stout, nearly cylindrical but somewhat angular, with several unequally prominent ridges whence arise rather distant, spreading, stiff, laterally compressed, slightly curved, narrow, very sharp prickles nearly half an inch long; much branched, branches very long, flexuose or ziczac, hard, cylindrical at their origin, afterwards strongly quadrangular, with the angles often slightly winged and armed with more or less numerous, laterally compressed, reversely hooked, sharp prickles. Leaves when full grown very large, alternate, stalked, nearly evergreen, but the blade at length deciduous; petiole about 2 inches long, often twisted, spreading, stout, quadrangular, usually with a few small straight prickles beneath, the lower half sheathing and winged, giving off at the point where the wing ceases two long slender spreading tendrils; blade at right angles with the petiole, reaching 12 inches

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* *Smilax*; σμῖλαξ was applied by the Greeks to several quite different plants; the σμῖλαξ τραχεῖα of Dioscorides, however, was probably the common *S. aspera*, L., of South Europe.

in length by 6½ in width, broadly oval-oblong, with nearly parallel sides, suddenly rounded off at the apex, which is obtuse with a small hard central point, strongly cordate, with rounded lobes at the base which is not wider than the rest of the leaf, entire, quite glabrous and shining on both sides, leathery, rich dark glossy green, with impressed veins above, duller and paler beneath, with the veins prominent, 7-nerved, the midrib very strongly marked, the two proximate to the midrib curved and coming from the very base, the outer ones fainter, all meeting at the apex and connected throughout by an irregular transverse network of veins; the upper leaves ovate, with the base wider but less cordate, bright apple green. Flowers and fruit not known.

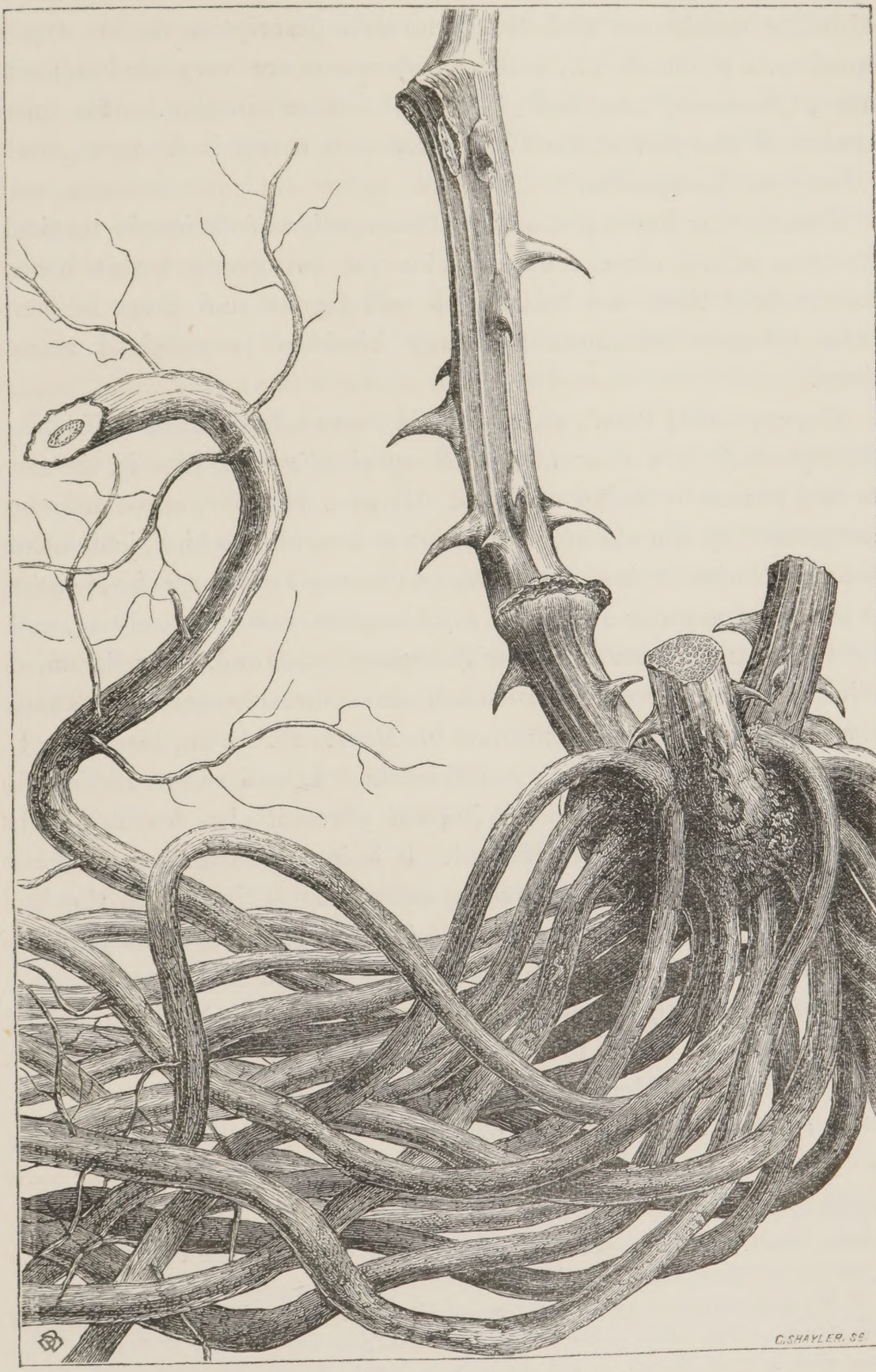
Habitat.—There is much obscurity in regard to this species, which is known by its stem and foliage only; the leaves are very variable throughout the genus, and it is probable that some other scarcely known species, *e. g. S. obliquata*, Poir., and *S. insignis*, Kunth, are the same as the present one.

The original specimens were obtained by Humboldt in 1805, at Bajorque, on the River Madalena, in New Grenada; his scanty fragments (now at Paris) have been examined by the late D. Hanbury, and recently fully described by A. De Candolle. The plant has also been collected in New Grenada by Warczewicz in 1853, and Mr. R. B. White in 1869, and the former traveller has gathered it also on the Chiriqui mountains in Veraguas, Central America, at an elevation of 4000—8000 feet. It probably occurs in other parts of tropical America, *e. g.* Guatemala and Peru.

The *Smilax* which is cultivated in Jamaica was considered by D. Hanbury to be *S. officinalis*, and to this species the same excellent authority referred the plant in cultivation at Kew, from which our plate is drawn. The Kew plant certainly seems to agree with specimens from Jamaica, collected by Dr. Daniell and now in the British Museum Herbarium;* it was obtained about 1866 from a nurseryman, with the name "*S. macrophylla maculata*,"†

* The woodcut on the opposite page is drawn from one of Dr. Daniell's specimens of the plant cultivated in Jamaica.

† De Candolle quotes this garden name as a synonym of *S. ornata*, Lam.,


C.SHAYLER, Sc.

it grows luxuriantly but has never flowered.* On a comparison of these specimens with De Candolle's description of the type-specimens of Humboldt, several differences are very obvious; we have, however, accepted Hanbury's determination. He also examined the root of the Kew plant and found it to agree with "Jamaica Sarsaparilla."

There is no doubt that many other species of *Smilax* in tropical America afford sarsaparilla, besides the two given in this book, but none of them are botanically well known, and there is very little accurate information of any kind to be obtained about them.

S. papyracea, Poir. (which Martius says affords Para or Lisbon Sarsaparilla), is a near ally of *S. officinalis*, and, like it, is not known except by leaf specimens. It can, however, apparently be recognised by the old stems and lower branches, which, instead of becoming more or less cylindrical, as in most other species, persist in the quadrangular state, and even become more intensely so, and have the angles furnished with closely crowded, very flattened prickles; the leaves are also much more membranaceous. These parts of the plant are figured in Mart. Fl. Bras., fasc. i, t. 1. Seemann combined it with *S. officinalis*. It is a native of French Guiana and North Brazil; Grisebach gives it also for Trinidad, but his plant is perhaps different. It is in cultivation in the Paris Jardin des Plantes. The *Smilax* collected by Spruce on the Rio Negro, and usually referred to this (no. 1871), is an allied species, *S. Spruceana*, A. DC. The specimens figured in Pharm. Journ., xii (1853), p. 470, of the plant affording Guatemala Sarsaparilla, cannot now be found for a re-examination of their specific characters, then considered to be those of *S. papyracea*.

S. syphilitica, Willd. (not of Bonpl. or Mart.), is figured, from

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which is a cultivated plant with variegated leaves, figured in Lemaire, 'Ill. Hort.,' xii, t. 439. Its position is uncertain, but from the figure it might possibly be referable to *S. officinalis*.

* We are informed by M. Linden, of Ghent, that the introduction into his collection of this same plant probably dates from the journey of Schlim, who met with it near Minca, in the environs of Santa Martha, New Grenada.

specimens of Humboldt's collecting, in Berg and Sch., t. xvii a. fig. A. The flowers of this also are unknown. It is a native of New Grenada.

S. pseudo-syphilitica, Kunth, is well illustrated in Berg and Sch., t. xvii a, fig. B and C, and good specimens exist in our herbaria from various collectors. Spruce collected it on the Rio Negro, North Brazil (No. 3789), but it appears to be a medicinally worthless species.

The name *S. Sarsaparilla,* Linn., no doubt included several species, *S. glauca,* Walt., a United States and Mexico plant, being one. It is that species which is figured in Woodville, t. 26, and copied in Steph. and Ch., t. 162.

The plant yielding Caracas Sarsaparilla is stated to be now nearly destroyed. Dr. Ernst, however, has sent a specimen to Prof. De Candolle, who considers it to be an undescribed species, but has not thought it well to publish it as new on the scanty material that can be obtained.

S. China, Linn. (which affords "Radix chinæ"), is a species of a different type from the sarsaparillas and a native of China, Formosa and Japan. It is figured in Woodville, t. 63, and Nees, t. 45. Dr. Hance believes that it is *S. glabra,* Roxb. (figured in Seemann's Bot. of H.M.S. Herald, t. 100), that affords this drug.

For magnified figures of the root-sections of many of the commercial varieties of Sarsaparilla, reference may be made to Berg's 'Anatomischer Atlas,' tt. 3 and 4.

Kunth, Enum. Plant., v, p. 228; A. DC., in Suites au Prod., i, p. 149; Seemann, in Proc. Linn. Soc. Lond., ii, p. 262 (1853), and Bot. H.M.S. Herald, p. 217; Bentley, in Pharm. Journ., xii (1853), p. 469; Martius, Fl. Brasil., fasc. 1, p. 5; Grisebach, Fl. Brit. W. Indies, p. 585; Hance, in Journ. Bot., 1872, p. 102; Lindl., Fl. Med., p. 599; Flück. and Hanb., Pharmacogr., p. 639.

Official Part and Names.—SARZÆ RADIX. *Jamaica Sarsaparilla;* the dried root of Smilax officinalis, *Humb.* and *Bonpl.* (B. P.). The dried root of Smilax officinalis (I. P.). SARSAPARILLA; the root of Smilax officinalis, *Humboldt & Bonpland,* and of other species of Smilax (U. S. P.).

It will be noticed that *Smilax officinalis,* which yields the so-called Jamaica Sarsaparilla, is alone official in the British Pharmacopœia, and in the Pharmacopœia of India; but that in the Pharmacopœia of the United States, while this is especially mentioned, other species of Smilax are also referred to. In this article, therefore, although more particularly describing Jamaica Sarsaparilla, we shall also allude to the other kinds of commercial sarsaparilla except that derived from *Smilax medica,* which will be noticed in our next article.

Collection and Preparation.—In the Amazon valley, according to information communicated to Hanbury by Spruce, the roots, which run horizontally in the ground, are collected by first scraping away the thin stratum of earth which covers them by hand, aided by a pointed stick, and after the roots are laid bare—(which is commonly a difficult operation, in consequence of the roots of other plants growing amongst them, which have to be cut through with a knife whenever they come in the way)—they are cut off near the crown, a few slender ones being allowed to remain to aid the plant in renewing its growth. The stems also are shortened down near to the crown, and a little earth and dead leaves heaped over the crown, which will then soon shoot out new stems. It is said that a full-grown plant will yield at the first cutting from 32 to 64 lbs. of roots; and that in a couple of years a plant "may be cut again, but the yield will be much smaller and the roots more slender and less starchy."

Spruce also states that, "those who gathered sarsaparilla for themselves were guided by the following characters:—1. Many stems from a root. 2. Prickles closely set. 3. Leaves thin. The first character was (to them) alone essential, for in the species of *Smilax* that have solitary stems, or not more than two or three, the roots are so few as not to be worth grubbing up; whereas the multicaul species have numerous long roots—three at least to each stem—extending horizontally on all sides." After being collected the roots are dried, prepared, and packed in bundles for transportation.

It should be noticed that the above mode of collection refers

to the kind of sarsaparilla known in commerce as *Brazilian* or *Lisbon Sarsaparilla;* but doubtless, although in some particulars it may differ from that adopted with the other kinds, yet that it is essentially the same in all. The mode of preparing, however, and of packing in bundles, varies much in the different commercial varieties of sarsaparilla.

General Characters.—The following characters are in substance those given by one of us in Pereira's 'Manual of Materia Medica.' *Sarsaparilla, Sarsa,* or *Sarza* of commerce, consists essentially of the roots of different species of *Smilax,* although nothing very definite is known respecting them, except those of *S. officinalis, S. medica,* and *S. papyracea.* In some kinds of sarsaparilla the roots are attached to the whole, or a portion, of the rhizome. This *rhizome* is commonly called *chump;* it is short, thick, and knotty, and has frequently attached to it at its smaller extremity the remains of one or more of the aerial stems; and a variable number of roots. The *aerial stems* are angular or rounded in form, and are commonly more or less prickly. The *roots,* which are *alone official,* are usually several feet in length, and of variable thickness, but on the average about that of a writing quill. Some are thin and shrivelled, and are therefore commonly said to be *lean;* while others are thick and plump, and are hence termed *gouty.* Frequently the roots give off, more or less abundantly, branched rootlets, in which case they are said to be *bearded.* In colour they vary much, being more or less red, brown, or yellow. The colour is doubtless modified by various circumstances, such as their washed or unwashed condition, the greater or less care taken of them in drying, the time of year when collected, the colour and nature of the soil in which they grow, the species from which obtained, and other circumstances. They have no marked odour in a dried state, but when boiled an evident and peculiar smell may be noticed. Their taste is commonly earthy, and in some roots mucilaginous, while in others, after chewing, they are slightly acrid, and feebly bitter. Upon making a transverse section of a root, it is seen to consist of a rind or false bark; and a woody zone inclosing a cellular centre, somewhat in

the manner in which the ring of wood surrounds the pith in an exogenous stem—the two together forming the meditullium.

Kinds of Sarsaparilla.—Several kinds of sarsaparilla are known in commerce, as *Honduras, Guatemala, Brazilian* or *Lisbon, Jamaica, Mexican* or *Lean Vera Cruz,* and *Guayaquil.* These differ from one another in the anatomical and other characters of their roots, in the manner in which they are folded and packed, and in the presence or absence, and characters, of the attached rhizomes and aerial stems. No perfectly satisfactory arrangement of the different kinds of sarsaparilla can at present be made; but for practical purposes, the subdivision suggested by Pereira into two groups—the *mealy,* or those in which starch is a very evident constituent, and the *non-mealy,* or those in which starch exists to a comparatively small extent—is by far the best.

1. *Mealy Sarsaparillas.*—This division includes three commercial kinds of sarsaparilla.—*Honduras, Guatemala,* and *Brazilian.* Formerly a fourth kind was included in this division, namely, *Caracas,* but this is no longer found in English commerce. In all mealy sarsaparillas the starch is far more evident in the parts of roots which are at a distance from the rhizome; indeed, in many cases, the roots near the rhizome are non-mealy. These mealy kinds not being official in the British Pharmacopœia need not be described, except in a general sense, but they all present the characters of Pereira's group of mealy sarsaparillas as follows :— The cortical layers, which are whitish or pale-coloured internally, contain a large amount of starch; indeed, this is sometimes so abundant that, when we break the roots, a shower of whitish dust or meal is thrown off from them. The thickness of the mealy or starchy coat varies, being sometimes nearly equal to the meditullium, but commonly not exceeding the $\frac{1}{3}$ or $\frac{1}{2}$ of it. When the mealy coat is very thick the roots have a swollen appearance, and the bark being brittle is frequently cracked transversely, and readily falls off. If a drop of sulphuric acid be applied to a transverse section of a root, the mealy coat is but little altered in colour, while the woody zone becomes dark purplish or almost

black. A decoction of a mealy sarsaparilla, when cold, becomes dark blue on the addition of a solution of iodine; and an aqueous extract, when rubbed down with water in a mortar, does not completely dissolve, but yields a turbid liquid, which becomes blue on the addition of iodine.

2. *Non-mealy Sarsaparillas.*—This division includes the kinds known as *Jamaica, Guyaquil,* and *Mexican Sarsaparillas.*—The former which is commonly regarded as being derived from *Smilax officinalis,* and is alone official, will be fully described presently; and Mexican sarsaparilla, under the head of *Smilax medica,* in our next article. Guyaquil sarsaparilla need not further be alluded to, except to state that it possesses the characters generally of non-mealy sarsaparillas, which are as follows :—They are characterised by a deep-coloured (red or brown) bark, which is either non-mealy, or contains but a very small amount of starch. The bark is much thinner in proportion to the meditullium than in the mealy, sarsaparillas, the diameter of the latter being frequently six or more times greater than the thickness of the bark. The roots never have a swollen or cracked appearance. If a drop of sulphuric acid be applied to a transverse section of the root of a non-mealy sarsaparilla, both bark and woody ring acquire a dark red or purplish tint. A decoction of a non-mealy sarsaparilla, when cold, does not yield a very evident blue colour when a solution of iodine is added to it; and an aqueous extract, when rubbed down with water, is completely dissolved, forming a clear solution, which does not become blue on the addition of iodine.

Jamaica Sarsaparilla.—This kind of sarsaparilla is not, as its name would imply, the produce of Jamaica, but is only so-called from having been originally obtained from Central America, by way of that island. It should be noticed, however, that *Smilax officinalis* is now cultivated to a small extent in Jamaica, but its roots are not valued in this country, from being pale coloured and more starchy than those derived from plants growing in their native localities. Jamaica sarsaparilla is also sometimes termed *red sarsaparilla* or *red-bearded sarsaparilla.*

The roots of Jamaica sarsaparilla are six or more feet in length;

they are usually bent or folded so as to form bundles of about eighteen inches long and four or five inches in diameter; these are secured by being bound together by a long root of the same drug. The bundles are but loosely packed, and are not trimmed. The roots are entirely free from their rhizomes, but are furnished with numerous branched rootlets. They vary in thickness, but do not exceed that of an ordinary goose-quill. The roots are commonly shrunken and furrowed; and vary in colour from a greyish- to a deep reddish-brown, the latter tint being regarded as the best. This sarsaparilla has no particular odour when dried; but its taste is feebly mucilaginous and bitter, and subsequently, after being chewed, acrid. Its decoction, when cold, although somewhat deepened in colour by a solution of iodine, does not become perceptibly blue. It yields a larger quantity of extract than any other kind of sarsaparilla; and this extract is perfectly soluble in cold water, and the solution does not become blue on the addition of iodine.

Comparative Therapeutical Value of the Kinds of Sarsaparilla.—Various opinions are held in different countries on the relative value of the different commercial kinds of sarsaparilla. In Italy, and generally in the southern parts of Europe, the thickest and most mealy roots are preferred; for although it is known that starch is not the active constituent of the root, it is regarded as contemporaneous with it. Pereira argues against this opinion as follows:—Firstly, the mealy sarsaparillas give to the test of sulphuric acid slighter indication of the active principle (*smilacin*), as evidenced by the darkening of their colour, than the non-mealy sorts; secondly, the mealy sarsaparillas are the least acrid to the taste; and, thirdly, the largest quantity of extract is obtained from a non-mealy kind—that known as Jamaica sarsaparilla. Generally speaking, in this country, *that sarsaparilla* is considered the best which has the deepest orange-red colour; the greatest number of rootlets; the most acrid taste; and which yields the largest quantity of extract. Hence Jamaica sarsaparilla, which possesses more than any of the other kinds these qualities, is preferred in England, and is alone official.

Composition.—The principal constituents of sarsaparilla are *starch, calcium oxalate crystals* (*raphides*), *resin, volatile oil,* and a peculiar principle which has been termed *smilacin, parillin, parillinic acid,* and *salseparin.* The medicinal activity is generally regarded as essentially residing in this smilacin; but the experiments of Boeker seem to show that it is destitute of any appreciable physiological or therapeutical action, hence further experiments on these points are desirable. *Smilacin* is said to be a neutral principle, and when pure colourless, and in the form of needle-shaped crystals. It is but very slightly soluble in cold, but much more readily so in hot water, and the solutions froth when shaken. It is also soluble to some extent in alcohol, but it is insoluble in ether. The solutions have a persistently acrid taste. Smilacin is coloured reddish-brown by the action of concentrated sulphuric acid. The *volatile oil* occurs in but very small proportion; thus, Pereira only obtained a few drops from 140 pounds of Jamaica sarsaparilla; he described it as heavier than water, and with the odour and taste of the drug.

Medical Properties and Uses.—Nothing very definite is known of the action of sarsaparilla; but it is commonly regarded as alterative, tonic, diaphoretic, and diuretic. As a remedial agent it is considered by a large number of practitioners as most valuable and efficient; while others regard it almost, if not entirely, inert. Although not so much used as formerly, it is still extensively employed in syphilitic affections; and it is also much valued as a remedy when the system has been injured by the too excessive use of mercurials in such cases. As a remedy in chronic forms of rheumatism, gout, scrofulous affections, skin diseases, especially when of long standing; and in other conditions of the system, when an alterative action is required, it is also regarded as a medicine of much value. The smoke of sarsaparilla has also been highly recommended in asthma. As a general rule, sarsaparilla is more esteemed by surgeons than physicians.

Gerarde's Herball, by Johnson, p. 859; Per. Mat. Med., vol. ii, pt. 1, p. 272; Per. Mat. Med., by B. & R., p. 460; Pharmacographia, p. 642; U. S. Disp., by W. & B., p. 779; Bentley,

in Pharm. Journ., ser. 1, vol. xii, p. 470, with figures; Spruce, in Journ. Linn. Soc., vol. iv, p. 185; Amer. Journ. of Pharm., vol. xv, p. 277; Journ. de Pharm., vol. xviii, p. 221.

DESCRIPTION OF PLATE.

Drawn from a specimen cultivated in the Royal Gardens, Kew.

A portion of a branch with a full-grown leaf, and from its axil a young branch with leaves.

D. Fitzr F.L.S. ad sicc. del. et lith.

SMILAX MEDICA, *Schlecht & Cham.*

M & N Hanhart imp.

N. Ord. SMILACEÆ.

Genus Smilax, *Linn.*

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290. Smilax medica, *Schlecht. & Cham., in Linnæa*, vi, *p.* 47 (1831).

Vera Cruz or Mexican Sarsaparilla.

Figures.—Nees, Supp.; Guimp. & Schlecht., Arzneigew., t. 296 (fide Kunth).

Description.—A large perennial climber. Rhizome short, thick, irregular, knotted, the nodes greatly thickened and giving off numerous long, tough, longitudinally striate, purplish-white roots with few rootlets. Stems stiff, hard, erect at the base and very bluntly angular, with several nearly straight prickles on the angles, much branched, the branches elongated, slender, very flexuose, tough, sub-terete or sub-quadrangular, striate, unarmed or with a few small, slightly reflexed prickles chiefly at the nodes. Leaves alternate, persistent, stalked, petiole 1—2 inches long, slender, deflexed, the lower $\frac{1}{3}$ or $\frac{1}{4}$ narrowly winged and occasionally armed with a few straight prickles, tendrils as long as the leaf, very slender; blade 4—8 inches long, ovate or oblong, with a broadly cordate-hastate base with rounded lobes, often somewhat constricted above the lobes, acute at the apex, entire, the margin slightly undulated, glabrous, thickly membranaceous, bright sap-green, rather paler beneath with the veins prominent, 5—7 nerved, the two proximate ones strong, running to the apex, the lateral ones chiefly basal, smaller veins reticulated. Flowers small, unisexual, dicœcious, stalked, greenish, the pedicels twice as long as the flowers, arranged 10—20 together in a small umbel (each with a very small lanceolate bractlet at the base) on the globose summit of the axillary peduncle, which is about as long as the petiole. Male flowers (not seen) :—perianth-leaves 6, in two rows, oblong-lanceolate; stamens 6, inserted on the very base of the perianth-leaves, filaments linear, anthers oblong, obtuse, basifixed, introrse, as long as the filaments. Female flowers :—

perianth-leaves ovate-oblong, obtuse, the inner ones rather the smaller; staminodes 2—4, hypogynous, strap-shaped, acute, about half as long as the pistil; ovary smooth, globular-ovoid, 3-celled, with a single pendulous ovule in each cell, stigmas 3, sessile, linear, short, recurved. Fruit a small berry, nearly globular, about $\frac{1}{3}$ inch in diameter smooth, red, about 8—10 in an umbel. Seeds 3, or more often 2, and then plano-convex, circular in outline, testa very thin, pale brown, embryo minute, at the very base of the hard horny endosperm.

Habitat.—This plant was discovered,* or at least first botanically discriminated, by Schiede, who gathered it in fruit in woods at Papantla, on the eastern side of the Andes of Mexico, in January, 1829 (not 1820, as usually stated). It has since been found further south in the same region at Orizaba and Vera Cruz, but is not known to grow elsewhere.

As a species it can be recognised by its sub-membranaceous hastate leaves and slender branches; the former, however, as in other species of *Smilax*, vary a good deal in size and form, even on the same specimen. There are frequently no prickles on the whole plant. The late Dr. Seemann placed this as a variety under *S. officinalis*, clearly from insufficient examination; he has not been followed by any other botanist.

The remarkable petiolar tendrils of this genus have been usually considered to be stipular in nature; A. De Candolle, however, believes them to be more probably modified leaf-segments or leaflets. The singular scale at the very base of each branch, looking like a supra-axillary bract, is the lowest leaf of the branch, which is always reduced to a short sheathing petiole without blade.

Smilaceæ seems to merit being considered a separate natural order, differing from *Liliaceæ*, with which several systematists combine it, by its diœcious flowers, highly specialised net-veined leaves and peculiar habit. It should, however, be restricted as is done by Lindley and by De Candolle in his recent monograph of the order. The former of these botanists placed *Smilaceæ* in his Dictyogens, a

* There are old specimens, unfortunately not localised, in P. Miller's Herbarium in the British Museum, probably collected by Houston.

class which, botanists are now agreed, cannot be maintained separate from other Monocotyledons.

Kunth, Enum. Plant., v, p. 237; A. DC., in Suites au Prod., i, p. 86; Flück and Hanb., Pharmacogr., p. 640; Lindl., Fl. Med., p. 598.

Official Part and Name.—Sarsaparilla; the root of Smilax officinalis, *Humboldt and Bonpland,* and of other species of Smilax (U. S. P.). In the British Pharmacopœia, and in the Pharmacopœia of India, the root of *Smilax officinalis,* or *Jamaica Sarsaparilla* is alone official; and in the Pharmacopœia of the United States *Smilax officinalis,* as just quoted, is the only species mentioned specially, hence the species now under description—*Smilax medica,* is only generally referred to in that volume under "other species of Smilax."

General Characters, Varieties, and Composition of Sarsaparilla.—The general characters, varieties, and composition of sarsaparilla, have been already fully described under "Smilax officinalis," hence we have now only to refer to that kind of sarsaparilla which is derived from *Smilax medica,* and which is distinguished in commerce, as *Mexican* or *Lean Vera Cruz Sarsaparilla.*

Mexican or *Lean Vera Cruz Sarsaparilla.*—This kind of sarsaparilla is imported from the Mexican ports of Vera Cruz and Tampico; but little, however, reaches this country, although large quantities are said to be imported into the United States. It belongs to the non-mealy group of sarsaparillas as we have noticed in the description of such sarsaparillas in our article on *Smilax officinalis.*

In this kind of sarsaparilla the roots, which are commonly about three feet in length, although varying in this respect from two to three feet, are unfolded, and are attached at one end to the rhizome or chump, to which also portions of the angular prickly or thorny aerial stems are frequently found adhering. These roots, which are often soiled with earth, are not made up into compact bundles, but are packed together in large, rather loose bales. They are thin, have a shrivelled, non-mealy cortex, a greyish-brown colour, very few rootlets, and a slightly mucilaginous,

but perceptibly acrid taste when chewed. It appears to be a good kind of sarsaparilla.

Medical Properties and Uses.—The properties and uses of this and other kinds of sarsaparilla are fully described in our article on *Smilax officinalis*.

Per. Mat. Med., vol. ii, pt. 1, p. 284; Pharmacographia, p. 645; U. S. Disp., by W. & B., p. 780; Pope, in Med.-Chir. Trans., vol. xii (1823), p. 344.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum collected by Schiede Mexico, the flower added from a specimen in the Kew Herbarium.

1. A branchlet with leaves and ripe fruit.
2. Transverse section of a berry.
4. A seed.
3. Vertical section of the same.
5. A female flower.
6. Vertical section of the same.
7. Transverse section of the ovary.

[8. Male flowers of *S. pseudo-syphilitica*, Kunth.]

(3–8 enlarged.)

D. Blair F.L.S. ad nat. del. et lith.

M&N. Hanhart imp.

ORYZA SATIVA, *Linn.*

N. Ord. GRAMINEÆ. Lindl. Veg. K., p. 106; Le Maout & Dec., p. 880.

Tribe *Oryzeæ*.

Genus **Oryza,*** *Linn.* Steudel, Syn. Gram., p. 2. Species about 12, natives of the hotter parts of both hemispheres.

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291. Oryza sativa, *Linn., Sp. Plant., ed.* 1, p. 333 (1753).

Rice. Nivara, Dhan (India).

Syn.—O. montana, *Loureiro*, &c. O. setigera, *Beauv.* O. latifolia, *Desv.*

Figures.—Nees, t. 36; Berg, Charact., t. 6, fig. 67; Host, Gram. Austriac, iv, t. 25; Nees, Gen. Fl. Germ.; Fl. Brasil., fasc. 51, t. 1.

Description.—An annual; stems much branched below, cylindrical, jointed, hollow, smooth, slightly striated, pale green, 2—10 feet long, the lower part floating in water or prostrate, with roots at the nodes, the rest erect. Leaves alternate; sheaths 6—12 inches long, not inflated, smooth, the lowest ones without blades; ligule in the largest leaves an inch long, erect, lanceolate, very acute; blade linear, 1—2 feet long, the largest nearly 1 inch wide, tapering to a sharp apex, edges minutely serrate, with sharp forward-pointing prickles, surface rough above, nearly smooth beneath, bright pale green, midrib well defined. Spikelets one-flowered, stalked, articulated with the expanded summit of the short pedicel, erect, laxly arranged on one side of the branches of the narrow terminal fastigiate panicle, which is about 9—15 inches long, at first erect, afterwards drooping; rachis flexuose, slightly rough, angular, with small tufts of woolly hair at the base of the branches; glumes very small, nearly equal, lanceolate-subulate, membranous, smooth, 1-nerved; pales equal, about three times the length of the glumes, boat-shaped, somewhat laterally compressed, keeled and more or less hairy at the upper part on the back, coriaceous, pale green, persistent, the lower pale (" flowering glume " of some authors), 3-nerved, some-

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* *Oryza, ὄρυζα,* the classical name for the grain.

what gibbous above, either blunt or acute or terminating in a sharp, smooth, purple awn, which is short or many times longer than the spikelet, the upper pale without obvious nerves or 3-nerved; beneath the pales the rachis is expanded into a small knob or callus. Lodicules 2, collateral, thick, fleshy, semi-transparent, pointed. Stamens 6, hypogynous, anthers exserted, linear, versatile. Ovary smooth, tapering; styles 2, short, stigmas red, with rough spreading hairs on all sides (aspergilliform). Fruit (caryopsis) enclosed in the persistent pales, which, however, are not adherent to it, $\frac{1}{4}$—$\frac{3}{8}$ of an inch long, oblong-ovoid, blunt, smooth, somewhat compressed; pericarp very thin, adherent to testa; embryo at the base of the narrow diameter of the seed on the outside of the abundant horny endosperm.

Habitat.—The Rice is no doubt native in India, in all parts of which the wild form is common by the sides of tanks, ditches, and rivers. According to Bretschneider's researches it is also doubtless indigenous to China. In both these countries it has been cultivated very extensively from remote antiquity. It was very early introduced into East Africa and Syria, and at the present day it is also grown in immense quantities in all the subtropical and tropical parts of the globe, having been long ago introduced into America, where it has now the look of a native plant. In Europe, Rice was introduced into the Mediterranean basin from Syria by the Arabs in the middle ages; it is now grown largely only in the plain of Lombardy. In England it has been cultivated as a curiosity from the days of Gerard, and may be seen treated as a water plant in the hothouses of most botanic gardens.

As is to be expected in the case of a cereal so long and extensively cultivated, there is a very great number of varieties. Moon enumerates no less than 160 kinds distinguished by the Cinghalese, and Roxburgh gives some 40 or 50 cultivated in India, where, he states, the wild form, though its grain is collected for use, is never cultivated. Irrigation is necessary for most sorts, but some varieties require little water, or can be grown even on ordinary dry ground. The chief differences are found in the greater or less

length of the grain, from narrowly ovoid to nearly spherical, and in its colour, which may be quite white, or black, or red, or mottled with brown; the pales also vary in colour, in hairiness, and greatly in the length of the awn.

Roxburgh, Fl. Ind., ii, p. 206; Moon, Cat. Pl. Ceylon, p. 26; Roemer & Schultes, Syst. Veg., vii, p. 1363; Kunth, Enum. Plant., i, p. 7; Steudel, Synopsis Gram., p. 3; De Candolle, Géogr. Bot., p. 941; Bretschneider, on the Study of Chinese Botanical Works, pp. 8, 9.

Official Parts and Names.—1. ORYZA; the husked seeds: 2. ORYZÆ FARINA; the Flour procured from the seeds (I. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of the United States.

1. ORYZA. *Rice.*—Rice in the state in which it is official in the Pharmacopœia of India, and ordinarily seen in commerce, may be described as varying in length from about one tenth to a quarter of an inch, as translucent, white, oblong-cylindrical in form, furrowed, blunt at both extremities, brittle, without odour, and with a mild demulcent taste. The varieties of Rice are very numerous; those most esteemed in this country are Carolina and Patna. Rice as described above, is called *Bras* by the Malays; and when enclosed in the husk, in which state it is also found, it is termed *Paddy*.

2. ORYZÆ FARINA. *Rice Flour.*—This is the flour procured from the seeds; it is commonly known in commerce under the name of *ground rice*.

Rice has been repeatedly analysed; it contains essentially the same constituents as the other cereal grains, namely, *starch, gluten* and other *nitrogenous substances, fatty matters,* various *inorganic constituents,* &c. The proportion of starch in rice has been estimated as varying from about 85 to nearly 90 per cent. The granules of rice starch are remarkable as being amongst the smallest of all known starch granules, being frequently under $\frac{1}{5000}$ of an inch in length. The proportion of nitrogenous constituents is about 7 per cent.; and of fatty matters 0·80 per cent. From a comparison with other cereal grains rice contains a larger

proportion of starch, much less nitrogenous substanccs, and less of fatty matters and inorganic constituents.

Medical Properties and Uses.—Rice has demulcent and nutritive properties, like those of wheat, for which it is commonly substituted in tropical countries. Decoction of Rice, commonly called Rice-water, is recommended in the Pharmacopœia of India as an excellent demulcent refrigerant drink in febrile and inflammatory diseases, and in dysuria and other affections requiring this class of remedies. It is rendered more palatable by being acidulated with lime juice, and sweetened with sugar. This decoction may be also used as an enema in affections of the bowels. Dr. Waring speaks highly of a poultice of Rice as a substitute for that of linseed meal; and finely-powdered rice flour may be used like that of wheat flour, as a local soothing application to erysipelatous surfaces, burns, scalds, &c. Rice Starch is applicable in like cases to that of wheat and other starches, both medicinally and in other ways; it is largely consumed at the present time.

The chief consumption of rice is as a food substance, the grain being more largely used for this purpose than that of any other cereal; it is, however, less nutritive than wheat and the other cereal grains in ordinary use, from the fact already noticed, of its containing a much smaller proportion of nitrogenous substances than is found in them. Being entirely free, however, from laxative qualities, it forms a light, digestible, and useful article of food for those in which there is a tendency to diarrhœa. It has been observed, however, that when substituted for potatoes in our workhouses in consequence of the failure of that crop, it has after a few months produced scurvy. This effect has been ascribed by Garrod to the small proportion of potash which rice contains in comparison with potatoes. Rice also contains less vegetable acids than potatoes, which doubtless has something to do with the injurious result attributed to its use. The various other ill effects, such as disordered vision, cholera, &c., which have been ascribed to its use, rest on no reliable foundation.

A kind of spirit called Arrack is sometimes distilled from the

fermented infusion of rice, but that name is only properly used in reference to the spirit distilled from Palm Wine or Toddy.

Per. Mat. Med., vol. ii, part 1, p. 73; Pharmacopœia of India, p. 254; Waring's Man. Pract. Therap., p. 531; Bentley's Man. Bot., pp. 37 and 686; Garrod, in Monthly Journal of Medical Science, January, 1848; Boussingault, in Ann. Chem. et Phys., vol. lxvii, p. 413.

DESCRIPTION OF PLATE.

Drawn from a specimen grown in the Royal Gardens, Kew.

1. A panicle and the uppermost leaf.
2. A spikelet.
3. Glumes.
4. Pales.
5. Lodicules (erroneously represented as opposite).
6. A flower.
7. Anther.
8. Stigma.
9. Fruit enclosed in the pales.
11. Transverse section of the same.
10. The grain.
12. Section through base of the same, showing embryo.

(2—12 enlarged.)

D Blair F.L.S. ad nat. del. et lith.

AVENA SATIVA, *Linn.*

M & N. Hanhart imp.

N. Ord. GRAMINEÆ.

Tribe *Aveneæ*.

Genus Avena,* *Linn.* Steud., Syn. Gram., p. 230. Species about 80, natives chiefly of the temperate regions of the world.

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292. Avena sativa, *Linn., Sp. Plant., ed.* 1, *p.* 79 (1753).

Oat.

Syn.—A. orientalis, *Linn.* A. nuda, *Linn.* A. chinensis, *Fisch.*

Figures.—Nees, t. 28; Host, Gram. Austriac., t. 59; Nees, Gen. Fl. Germ.

Description.—An annual herb, with several erect, smooth, jointed stems, 2—4 feet high. Leaves few, the sheaths very long, smooth, striate, glaucous green, ligule prominent, truncate, blade about 6 inches long, lanceolate-linear, broad at the base, tapering to the acuminate apex, smooth, pale green. Spikelets not very numerous, rather large, 2- or 3- (rarely more-) flowered, with the second flower stalked and the upper usually reduced to a mere rudiment, solitary at the ends of slender filiform pedicels thickened at the extremity, pendulous or nodding, opening widely when in flower, arranged very laxly on the widely spreading or more close, slender, unequal, whorled branches of a very large terminal tapering pyramidal panicle; glumes 2, nearly equal, large, ¾—1 inch long, thin and membranous, pale green, boat-shaped, rounded on the back, acuminate and tapering, with nine nearly equal veins, exceeding the flowers (excepting the awn); pales 2, the lower one faintly nerved, quite smooth, becoming hard and coriaceous, rounded, not keeled, lanceolate, bifid at the apex with two sharp points, and giving off at a little above the middle a strong tapering slender long rough awn, twisted in its lower portion, about 1½ times as long as the pale and projecting far beyond the glumes (the upper flower usually without an awn), upper pale large, nearly as long as the

* *Avena*, the classical Latin name, of Celtic origin.

lower one, membranous, 2-toothed, with narrowly inflexed margins. Lodicules 2, tapering, entire, ciliate. Stamens 3, ultimately exserted, anthers yellow. Styles 2, short, nearly sessile, plumose, white. Fruit closely surrounded by but not adherent to the persistent, hardened, yellowish or more or less brown or nearly black pales, small, about $\frac{1}{3}$ inch long, narrowly oval-oblong, narrowed at both ends, silky, deeply furrowed down the inner side.

Habitat.—This cereal is so little different from certain wild European species of *Avena*, that it may well be believed to have been developed by cultivation from one or more of them. It has indeed been stated that good oats have been obtained by experimental culture of the common English wild oat, *A. fatua*, L., in the course of a few years. This latter species is a troublesome corn-field weed, and differs from the cultivated oat in its larger size and in having all the flowers provided with long awns and the lower pale covered below with long yellow hairs. Another wild species, *A. strigosa*, Schreb., is more like the cultivated race called Tartarian oats (*A. orientalis*) so much grown in Scotland, but differs in having the lower pale ending in two long bristles.

We have no earlier record of the cultivation of oats than the Roman period when Pliny mentions its growth for food in Central Europe. It was not known to any of the ancient nations, nor have we any notice of it in India or China in old times. The cultivation probably originated in Hungary or some neighbouring part of Eastern Europe. At the present day it is grown extensively in all temperate climates, especially in those countries with a low summer temperature and a moist atmosphere, as the north and west of Great Britain, where the best oats are grown. A very large number of different sorts are recognised by farmers, characterised by the branching of the panicle and colour of the grain.

Kunth, Enum. Plant., i, p. 301; Steud., Syn. Gram., p. 230; DC., Geogr. Bot., p. 938; Alefeld, Landwirthsch. Flora, p. 319.

Official Part and Names.—Avenæ Farina; the meal prepared from the seed (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India; but it was formerly

recognised in the London, Edinburgh, and Dublin Pharmacopœias. It is commonly known as Oatmeal.

General Characters and Composition.—As found in commerce, the grains or caryopsides are usually enclosed in their pales; it is these grains, divested of their pales, which are used for medicinal and dietetical purposes, and which are commonly, though incorrectly, termed seeds. When the grains are deprived of their integuments, they are called *groats;* and these, when crushed, form what have been denominated *Embden groats.* The official meal known as *oatmeal* is prepared by grinding the grains. Oatmeal has a whitish-brown colour, but is not so white as wheaten flour; it has no odour, but its taste is very slightly, although not unpleasantly, bitter.

The composition varies in different grains, and also according to their mode of preparation, but on an average is as follows:—*Starch,* 66; *gluten, albumen,* and other protein compounds, 18; *sugar, gum, oil,* &c., 12; *salts,* &c., 4. The proportion of protein compounds exceeds that of wheaten flour; and oats are richer in oily or fatty matter than any other of the cultivated cereal grains, with the exception of Maize or Indian corn. Hence oats are among the most valuable of grains for dietetical purposes.

Medical Properties and Uses.—The only way in which oats are employed in medicine is in the form of *gruel;* which is prepared by boiling an ounce of oatmeal or groats in three pints of water to a quart, and then straining the decoction. Sugar, lemon juice, raisins, &c., are sometimes added to improve its flavour. Gruel is a mild, nutritious, and easily digested aliment in fevers and inflammatory affections. As the basis of *caudle,* it is also in general use after parturition. Gruel may also be employed as an emollient in poisoning by acrid substances. It is also frequently given after cathartic medicines in order to render their action easier and more efficient. It is likewise used as a demulcent enema; and the meal, when boiled into a thick paste with water, forms an excellent emollient poultice.

As a dietetical agent oatmeal is most valuable. It is very largely used in Scotland, &c., in the forms of oat-cake or unfer-

mented oat-bread, and oatmeal porridge; and as oatmeal has a somewhat laxative tendency when taken in the form of porridge at breakfast, it is sometimes useful in habitual constipation. The use of oat-cake, however, as a diet, in some cases, produces indigestion in those unaccustomed to its use.

Per. Mat. Med., vol. ii, pt. 1, p. 77; Christison, Disp., p. 200; U. S. Disp., by W. & B., p. 160; Watts, Dict. Chem., vol. i, p. 823.

DESCRIPTION OF PLATE.

Drawn from a specimen grown in Chelsea Gardens.

1. A panicle in fruit.
2. A spikelet.
3. A glume.
4. Lowest flower.
5. Lower pale.
6. Upper pale.
7. Flower without the pales.
8, 9. Fruit with the investing pales.
10, 11. Inner, and—12. Outer surface of fruit.
13. Vertical, and—14. Transverse section of fruit.
15. Section to show the embryo.

(4–7, 9, 11–15 enlarged.)

D.Blair F.L.S. ad nat. del. et lith.

HORDEUM VULGARE, *Linn.*

M & N. Hanhart imp.

N. Ord. GRAMINEÆ.

Tribe *Hordeæ*.

Genus Hordeum,* *Linn.* Steudel, Syn. Gram., p. 351.
Species over 30, natives of various temperate countries.

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293. Hordeum vulgare, *Linn., Sp. Plant., ed.* 1, *p.* 84 (1753).

Barley. Bere. Big.

Syn.—H. hexastichon, *Linn.* H. distichon, *Linn.* H. Zeocriton, *Linn.*, &c.

Figures.—Nees, t. 29; Host, Gram. Austriac, iii, tt. 34—37; Nees, Gen. Fl. Germ.

Description.—An annual herb. Stems several, 2—3 feet high, smooth, jointed. Leaves few, the upper one close beneath the spike, sheaths smooth, striate, ligule very short, blade erect, oblong linear, somewhat rounded or auriculate at the base, tapering to the acute apex, smooth, glaucous green. Spikelets rather large, 1- or rarely 2-flowered, not very numerous, arranged in threes, sessile, compressed, the two lateral usually barren, smaller and withered, the triplets inserted distichously on opposite sides of an excavated flattened rachis, crowded and overlapping and collectively forming a cylindrical or flattened linear-oblong spike 3—4 inches long without the awns; glumes 2, small, equal, setaceous, rigid, awn-like, placed on the outer side of the triplet of spikelets, and looking almost like an involucre; pales 2, the lower strong, boat-shaped, 5-veined, smooth, extended into a very long terminal, dorsally-flattened, tapering awn, over 4—6 inches long, with a strong central rib and the margins very rough with minute forward-pointing prickles (of the barren spikelets without an awn), the lower pale membranous, nearly as long as the upper (without the awn), 2-toothed, 2-veined, with strongly inflexed margins. Lodicules 2, entire, ciliate or hairy. Stamens 3, hanging out of the open flower, anthers yellow. Ovary pubescent on the top, stigmas 2, distant, nearly sessile, feathery. Fruit enclosed in,

* *Hordeum*, the classical Latin name; in Greek κριθή.

and adherent to, both the upper and lower pales, about $\frac{3}{8}$ inch long, oblong-ovoid, tapering at both ends, dorsally compressed and flattened on the sides so as to have two lateral angles, with a shallow longitudinal furrow down the front, smooth but harsh, pale greyish yellow.

Habitat.—Barley has been cultivated from remote antiquity, as by the ancient Egyptians, Jews, and Chinese. It is not known wild at the present day, though some closely allied species occur in a wild state. The home of the plant is considered to be probably the Southern Caucasus and the shore of the Caspian Sea.

Its cultivation now reaches over a remarkably extended range, for barley is the most tolerant of climate of all the cereals. It can be successfully grown in Norway up to 70° N. Lat. and in Lapland and Northern Canada, and at the same time is a successful crop in North Africa and the central districts of Asia. In this country it is grown in all parts on light and dry soil even to the north of Scotland.

Though we have placed all the cultivated barleys under one species, *H. vulgare,* that name more strictly applies to one variety and that one of the least valuable, the Bere or four-ranked Barley, grown especially in the highlands of Scotland and Ireland. In this all the spikelets are developed, the lateral ones forming a sort of double row on each side, so that this kind of barley is often termed 4-ranked barley. In the kind called *H. hexastichon* also the lateral rows of spikelets are developed, but are more separated and the ear is distinctly 6-ranked ; this variety is little cultivated. Most of the best barleys are referable to *H. distichon,* in which the two lateral spikelets of each cluster are abortive, consisting only of the chaffy bracts, the ear is consequently 2-ranked. *H. Zeocriton,* the battledore barley, is a variety with the ear broad below and tapering to the end. There are also " naked " varieties in which the grain does not adhere to the pales. Probably all are forms of a single original.

Kunth, Enum. Plant., i, p. 455 ; Steudel, Syn. Gram., p. 351 ; Alefeld, Landwirthschaftl. Bot., p. 339 ; DC. Geogr. Bot., p. 935 ; Lindl., Fl. Med., p. 610.

Official Part and Names.—Hordeum Decorticatum; the husked seeds of Hordeum distichon (B. P.). The husked seeds (I. P.). Hordeum; the decorticated seed (U. S. P.). It is also termed Pearl Barley in the British Pharmacopœia and the Pharmacopœia of India; and Barley in the Pharmacopœia of the United States.

General Characters and Composition.—The grains or caryopsides as found in commerce, are commonly enclosed in the pales. When deprived of these by a mill they form *Scotch, hulled,* or *pot barley;* and when all the integuments are removed, and the seeds rounded and polished, they constitute the *official* or *pearl barley.* Pearl barley as thus prepared is white, rounded, and retains a trace of the longitudinal furrow of the grain. It has the ordinary farinaceous taste of most cereal grains, but no marked odour. The meal obtained by grinding pearl barley to powder is termed *patent barley. Malt* is barley which has been made to germinate by moisture and heat, and afterwards dried, by which the vitality of the seed is destroyed. The colour of the malt varies according to the temperature at which it has been dried. Thus we have *pale malt, amber malt, brown malt,* and *roasted* or *burned malt.*

Barley has been repeatedly analysed; but the average composition of barley-meal may be given as follows:—*Starch* 68; *gluten, albumen,* &c., 14; *fatty matter* 2; *saline matter* or *ash* 2; water 14. It will thus be seen that the amount of albuminous principles or protein compounds is much less in barley than in wheat or oats.

Medical Properties and Uses.—Pearl barley is used in medicine in the form of the official decoction, which is commonly termed barley water, as a demulcent, emollient, and nutritious drink, in febrile and inflammatory affections; and as a vehicle for other medicines. It is frequently flavoured with sugar and slices of lemon; or raisins and figs are sometimes added to render it slightly aperient. A decoction of hulled barley or of malt is also sometimes employed for similar purposes as that of the official decoction of barley. An extract of malt is also occasionally prepared by evaporating sweet wort to the consistence of a treacly

fluid ; this may be added to tea, milk, &c., and the mixture used as a slight tonic in cases of debility, more especially when attended by suppuration.

Barley is also employed dietetically, but it is less valuable as a nutritive agent than wheat. A mixture of one part of barley meal and three parts of wheaten flour is sometimes used as food for infants ; the addition of barley meal being made to remove the constipating effects commonly attributed to wheaten flour.

Both Scotch and pearl barley are also frequently employed to thicken soups ; and in the preparation of dietaries.

The chief use of barley, however, is for the preparation of malt, by the fermentation of an infusion of which with hops, ale and beer are obtained.

Per. Mat. Med., vol. ii, pt. 1, p. 83; Pharmacographia, p. 658; U. S. Disp., by W. & B., p. 458; Watts, Dict. Chem., vol. i, p. 825.

DESCRIPTION OF PLATE.

Drawn from specimens grown in Chelsea Garden.

1. A spike in flower (*H. vulgare*).
2. A cluster of three spikelets.
3. The same with the awns removed.
4. A glume.
5. Outer ; and 6. Inner side of lower pale.
7. Inner ; and 8. Outer side of upper pale.
9. A flower with pales.
10. The same, the pales removed.
11. Lodicules.
12. Ovary.
13. A spike in fruit (*H. distichon*).
14. 15. Inner ; 16. Side ; and 17. Outer side of grain.
18. Transverse section of the same.

(4–12, 15–18 enlarged.)

D.Blair F.L.S. ad nat. del. et lith.

TRITICUM SATIVUM, *Lam.*

M & N. Hanhart imp.

N. Ord. GRAMINEÆ.

Tribe *Hordeaceæ*.

Genus **Triticum**,* *Linn., in part.* Excluding *Agropyrum*, the species are known only in a cultivated state, and variously estimated at from 2—20.

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294. Triticum sativum, *Lam., Encyc. Meth.*, ii, *p.* 554 (1787).

Wheat.

Syn.—T. æstivum, *Linn.* T. hybernum, *Linn.* T. vulgare, *Vill.* T. turgidum, *Linn.* T. compositum, *Linn.* T. durum, *Desf.*, &c.

Figures.—Nees, t. 31; Host., Gram. Austr., iii, tt. 26—28, and iv, tt. 5—8; Nees, Gen. Fl. Germ.

Description.—An annual herb, with many long, much branched, fibrous roots. Stems several, about 3 feet high, erect, cylindrical, jointed, hollow except at the joints which are oval polished and swollen, smooth, hard, striate, pale green, with a blueish "bloom" on the surface. Leaves few, distant; sheaths long, close, not swollen, striate, smooth in the upper part, rough with short deflexed hairs below; ligule short, truncate or torn; blade 6—18 inches long, slightly spreading, flat (involute when dry), linear, attenuate into a long sharp point, smooth on both sides, somewhat ridged above, glaucous green. Spikelets large, 3—5-flowered with the terminal flower barren, not numerous (12—24 and a terminal odd one), quite sessile, compressed, inserted in a strictly distichous manner on alternate surfaces of the flattened, deeply excavated rachis, usually overlapping, somewhat crowded, collectively forming an oblong-linear, acute, terminal, quadrangulo-cylindrical spike 3—5 inches long, usually with one or two small abortive spikelets at the base; glumes 2, equal, irregularly boat-shaped, oblong-oval, obtuse, but with the midrib slightly excurrent into a short compressed beak, often unequal-sided, faintly veined, parchment-like, stiff, smooth and shining, the midrib rough with minute forward prickles, or all pilose or hairy; pales 2,

* *Triticum*, the classical name.

nearly equal in length, the lower boat-shaped, keeled above, obtuse or mucronate or more or less awned at the apex, obscurely veined, like the glumes in texture, smooth or hairy, the upper thin, papery and transparent, with two sharply prominent green veins rough with minute prickles, and strongly inflexed sides. Lodicules 2, thick, usually rounded and entire, hairy at the top. Stamens 3, filaments delicate, anthers large, oblong-linear, very pale yellow, hanging out of the flowers after dehiscence. Ovary obovate, truncate, with a tuft of white hairs on the top; stigmas 2, nearly sessile, feathery with simple hairs. Fruit enclosed in, but separate from, the persistent somewhat enlarged yellow pales, about $\frac{1}{6}$ inch long, ovoid, rounded on the back, flatter and with a deep central groove on the ventral surface, blunt and hairy at the top, otherwise smooth, bright yellow, embryo as in other grasses.

Habitat.—The remark so frequently made in this book with regard to our ignorance of the origin and home of commonly cultivated plants is especially true of the wheat. No form of it has ever been seen wild, nor any species indeed very closely resembling it. It is, therefore, probable either that it has been very much altered from the original wild grass,—which tradition and probability would lead one to consider a native of some part of Central Asia,—or that from changes of climate in the country of its origin it has become extinct as a wild plant. In favour of the latter supposition in preference to the former is the fact that, like other annual cereals, the wheat shows very little tendency to vary; the forms cultivated in ancient Egypt, in China, and in Palestine appear to have been identical in all respects with those we are now familiar with.*

The cultivation of this plant is coeval with the history of man, and its grain has always formed the staple food of the most civilised portions of the human race. It is essentially the cereal of

* The accidental variety called *T. compositum*, the "double-eared wheat" of old authors, is often termed "Egyptian" or "Mummy" wheat; but there is no reason to suppose that it was more frequent in Egyptian culture than in our own fields at the present day. We are informed by Dr. Birch that the wheat represented in the scenes of the tombs is the ordinary single-eared, and there is no known instance of double-eared wheat being represented.

temperate climates, and its cultivation ceases, speaking generally, south of 60°, and north of 25° N. Lat.; Europe, North America, Asia, and a small part of Africa being included in its area.

It is not within our province to enumerate the varieties of this cereal. Many have been considered species; thus Kunth gives 11 and Steudel 20 species of cereal wheats, whilst Alefeld gives 60 varieties under a single species. Of those here considered as falling under *T. sativum*, the chief differences consist in the presence or absence of awns, the smoothness or hairiness of the spikelets and their size and number of flowers, and the colour of the glumes and grain. By combinations of these characters are distinguished a great many forms by agriculturists.

The spelts are forms of *T. Spelta*, Linn., a distinct species, also of very ancient cultivation, though always to a less extent than wheat. Its grain does not separate readily from the chaff, and the spikelets are more distinct and fewer-flowered. Figures will be found in Host. Gram. Austriac., iii, tt. 29—32.

The wild grasses to which wheat is structurally most allied are members of the genus *Ægilops*, natives of the Mediterranean region and Asia Minor, and many botanists consider that, different as it is, *Æ. ovata* ought to be regarded as the parent of most, if not all, of our cultivated varieties, whilst the spelt is derived from *Æ. caudata*. Experiments have shown that the former grass can be fertilised by wheat pollen and some very variable hybrids produced, *e.g. Æ. triticoides* and *Æ. speltæformis*, but it is not clear that prolonged cultivation for a series of years in gardens has shown any tendency in *Æ. ovata* towards improvement. It is scarcely necessary to say here that such fables as the "transformation" of one cereal into another are not worthy of serious discussion, and are to be placed alongside of the stories of germination of "mummy" wheat as either errors of observation or intentional deceptions.

Steudel, Syn. Glum., p. 341; Kunth, Enum. Pl., i, p. 438; DC., Géogr. Bot., p. 928; Alefeld, Landwirthsch. Bot., p. 322; Godron, in Bull. Bot. Soc. France, xxiii, p. 397; Lindl., Fl. Med., p. 610.

Official Parts and Names.—1. FARINA TRITICI ; the grain of wheat (Triticum vulgare, *Villars*), ground and sifted : 2. AMYLUM ; the starch procured from the seeds of common wheat : 3. MICA PANIS ; the soft part of bread made with wheat flour (B. P.). 1. The grain of wheat, ground and sifted : 2. Starch procured from the seed (I. P.). AMYLUM ; the fecula of the seed of Triticum vulgare (U. S. P.).

1. FARINA TRITICI. *Wheaten Flour.*—Wheat grains are commonly termed seeds, but in reality they are a kind of fruit called a caryopsis. When brought to market, they have been divested of their pales (chaff). They vary in size, appearance, hardness, and thickness of integuments, and hence they vary in the relative proportion of flour and bran which they yield. They are prepared for use by grinding and sifting, by which the farina or flour is separated from the bran ; the latter forming from 25 to 33 per cent.

General Characters and Composition.—Wheaten flour is white, without odour, and nearly tasteless. Its principal constituents are *starch, gluten, albumen, dextrine,* and *sugar ;* but the proportion of these and of the other substances it contains will vary much, according to the variety of grain, soil and climate in which the plant yielding it has been grown, mode of culture, time of cutting, and character of manure. Thus the percentage of starch varies from 52 to 75 ; that of gluten and albumen from 10 to 23 ; and that of dextrine and sugar from 6 to 13 per cent. If moistened wheat flour be kneaded into a stiff paste, and well washed on a sieve by a stream of water, a milky liquid passes through, and a viscid, greyish-white, elastic mass is left behind, called *crude gluten.* The milky liquid holds in suspension *starch ;* and in a state of solution *gum, sugar,* and *albumen.* The crude gluten is composed of *vegetable fibrine, glutin* or *gliadin, casein,* and *oil.* Gluten is essentially the flesh-forming constituent of flour, and it is in the large proportion of this nitrogenous substance which wheat grains contain, that they owe essentially their superiority over the other cereal grains for the preparation of bread. It is the glutin or gliadin which gives to the nitrogenous portion of wheat flour its peculiar adhesiveness, and

causes the dough prepared with it to rise into a spongy mass when penetrated by gases. This is another great cause of the superiority of wheaten bread over that prepared from other cereals; for these contain but comparatively little glutin, so that the bread prepared from them possesses but little tenacity.

Medical Properties and Uses.—Wheaten flour is but little used in medicine, but it may be sprinked on the skin in erysipelatous inflammation, and various itching or burning eruptions, as nettle-rash, and also in burns and scalds. When employed for the latter, it cools the part, excludes the air, and absorbs the discharge, forming a crust which effectually protects the subjacent part. When the crust has become detached by the accumulation of purulent matter beneath, a poultice may be applied, and after its removal, the exposed surface may be again sprinkled over with flour. A mixture of flour and water is also used as an antidote in poisoning by the salts of mercury, copper, zinc, silver, and tin, and by iodine. Wheaten flour is also occasionally employed in pharmacy for enveloping pills.

Bran is sometimes used in the form of a decoction or infusion, as an emollient bath; and also internally as a demulcent in catarrhal affections and bowel complaints. Bran poultices are also useful in abdominal inflammation, spasms, &c. Bran taken in substance is laxative, hence bran bread, which is made from unsifted flour, may be used with advantage in certain dyspeptic cases. Bran bread, made from coarse wheat bran, has also been employed with success in the treatment of diabetes; its value in this disease being due to the almost entire absence of starch.

Besides their use in the manufacture of bread, wheat grains are employed in the preparation of various nutritious foods, as Hard's food, Semolina, Soujee, Manna Croup, Vermicelli, Maccaroni, Cagliari or Italian paste, &c.

2. AMYLUM.—*Preparation.*—The mode of preparing starch is given by Pereira, as follows:—A mixture of coarsely ground wheat is steeped in water in a vat for one or two weeks (according to the state of the weather), by which acetous fermentation is established. The acid liquid, called *sours*, is drawn off, and the

impure starch washed on sieves to separate the bran. What passes through is received in shallow vessels, termed *frames*. Here the starch is deposited. The sour liquor is again drawn off, and the *slimes* removed from the surface of the starch, which is to be again washed, strained, and allowed to deposit. When, by these processes, the starch has become sufficiently pure, it is boxed; that is, it is placed in wooden boxes perforated with holes and lined with canvas, where it drains. It is then cut into square lumps, placed on chalk stones or bricks, to absorb the moisture, and dried in a stove. By this process the blocks are *crusted*. The blocks are then scraped, papered, labelled, stamped, and returned to the stove. Here they split into columnar masses, which are commonly called races.

General Characters.—In white columnar masses. When rubbed in a mortar with a little cold distilled water, it is neither acid nor alkaline to test paper, and the filtered liquid does not become blue on the addition of solution of iodine; but mixed with boiling water and cooled, it gives a deep blue colour with iodine.

Two kinds of wheat starch are known in commerce—one *white*, the other *blue;* the former should be alone used for medicinal purposes. Blue starch owes its colour to finely powdered smalt, or indigo, which is introduced into it before the boxing process. When examined by the microscope, starch is seen to be composed of varying sized granules; the larger being rounded, and flattened or lenticular; while the small ones are spheroidal or nearly so. Each granule is marked at or near its middle by a rounded, elongated, or slit hilum, around which are concentric rings. When heated to about 300° wheat starch acquires a buff colour, and is converted into dextrine and then becomes soluble in water like gum; hence dextrine is known in the arts as *British gum* or *leiogomme*.

Medical Properties and Uses.—Starch powder is used for sprinkling over inflamed surfaces, &c., to absorb acrid secretions, and prevent excoriation. In the form of the official mucilage it possesses demulcent properties, and may be used as an enema in irritated conditions of the rectum, and as a vehicle for the forma-

tion of other more active enemas. Starch may also be employed as an antidote to poisoning by iodine. Mucilage of starch is also useful to the surgeon for stiffening bandages when applied to fractured limbs, &c.

Besides its use as above, blue starch is largely employed by the laundress for stiffening linen; and the substance prepared from starch, and known as dextrine or British gum is, extensively used in the arts.

3. Mica Panis.—Crumb of bread, as official in the Pharmacopœia, is the soft part of the ordinary fermented loaf bread, which is commonly made with wheat flour, salt, water, and yeast, and to which a portion of potatoes is commonly added to assist fermentation, and to render the bread lighter.

Medical Properties and Uses.—Crumb of bread is very useful in giving bulk to pills in which very active medicines are administered in minute doses. In the form of a poultice made with boiling water or milk, slices of bread constitute a valuable emollient application; or when decoction of poppy, or Goulard's water, is substituted for common water, this is a very useful preparation for applying in phlegmonous inflammation, and in the treatment of irritable ulcers.

The use of bread as an article of diet does not come within our province, but the causes of its especial value over cereal grains generally, have been referred to by us in treating of wheaten flour.

Per. Mat. Med., vol. ii, pt. 1, p. 89; Per. Mat. Med., by B. & R., p. 406; U. S. Disp., by W. & B., pp. 118 and 397; Watts' Dict. Chem., vol. i, pp. 656 and 823.

DESCRIPTION OF PLATE.

Drawn from specimens cultivated in Chelsea Garden. 1. A spike in flower. 2. A spikelet. 3. Glumes. 4. A flower with the pales. 5. A flower. 6. Pistil. 7. Part of stem with a leaf. 8. A ripe ear. 9. Pales enclosing the grain. 10, 11. Grain. 12. The same, dorsal view. 13. Vertical, and—14. Transverse section of the same. 15. Whole plant, $\frac{1}{8}$ nat. size. (2–6, 9, 11—14 enlarged.)

D.Blair F.L.S. ad nat. del. et lith.

M&N.Hanhart imp.

LOLIUM TEMULENTUM, *Linn.*

N. Ord. GRAMINEÆ.

Tribe *Hordeaceæ.*

Genus **Lolium,*** *Linn.* Steudel, Syn. Gram., p. 339. Species about 12, natives chiefly of temperate regions in both hemispheres.

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295. Lolium temulentum,† *Linn., Sp. Plant., ed.* 1, *p.* 83 (1753).

Darnel. Bearded Darnel.

Syn.—L. arvense, *With.* L. robustum, *Reich.*

Figures.—Steph. & Ch., t. 3. Syme, E. Bot., xi, tt. 1816, 1817; Host, Gram. Austriac., t. 26; Reichenb., Ic. Fl. Germ., i, t. 5; Nees, Gen. Fl. Germ.

Description.—Annual. Stems several, erect, reaching a height of 3 feet or more, stiff, smooth, often branched from the lower nodes. Leaves large, distant; sheaths smooth, striate, ligule short, truncate, blade 5—10 inches long, spreading and drooping, $\frac{1}{4}$—$\frac{1}{2}$ inch wide, linear, gradually tapering to the acute apex, dark green. Spikelets large, $\frac{1}{2}$—1 inch long, 5—11-flowered, sessile, laterally compressed, blunt, arranged singly edgewise alternately on opposite sides of the elongated rachis, forming a narrow distichous spike 6—12 inches long; rachis somewhat flexuose, hollowed on alternate sides to receive the spikelets, faintly rough; glumes 2 in the terminal spikelet, nearly equal, only 1 in the remainder, placed on the outer side of the spikelet, closely appressed, and equalling or exceeding it in length, rather leaf-like, 5-ribbed, convex, smooth, green, subacute, not awned; pales 2, nearly equal in length, the lower rounded on the back, the edges somewhat involute, 5-ribbed, the two outside ribs very strong, obtuse, and membranous at the apex, a little below which arises usually a straight white awn of variable length, the upper pale flat, appressed to the dorsal one, with its margins folded

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* *Lolium*, the classical name for some cornfield weed.

† *Temulentum*, drunken; from its alleged effects. Name used by Lobel in 1570.

over on the inside, scarious, with two green veins, faintly ciliate on the edges. Lodicules 2, connected at the base, entire. Stamens 3, ovary rounded. Stigmas 2, aspergilliform. Fruit enclosed in the pales (the lower one turgid and thickened), oblong-ovoid, nearly $\frac{1}{4}$ inch long, blunt, concave on inner surface, pale brown.

Habitat.—In England this grass is usually found as a cornfield weed, and is probably in most cases sown with the crop; it is not very commonly met with, and does not grow in the north of Scotland. It occasionally occurs as a wayside weed and in waste ground. The plant extends throughout Europe and Western Asia, and has been found in Madeira, North Africa, and India; it has also been introduced into the United States of America and Australia.

This species is easily distinguished from the common Rye- or Ray-grass, *L. perenne*, L., by its long glumes and turgid fruiting pales, containing the large grain.

A second glume is sometimes found, of much smaller size, on the side of the spikelet next the main rachis. The awns are frequently quite absent; the plant is then *L. arvense*, With.

Syme, E. Bot., xi, p. 187; Hook. f., Stud. Fl., p. 454; Watson, Comp. Cyb. Br., p. 405; Ledebour, Fl. Rossica, iv, p. 345; Steudel, Syn. Gram., p. 340; Kunth, Enum. Plant., i, p. 437; Lindl., Fl. Med., p. 609.

Part Used and Name.—Lolii Semina; the seeds or grains (caryopsides). The seeds or grains of Darnel were used medicinally by the ancient Greeks and Romans, but were never official in our pharmacopœias. They are referred to here on account of the plant yielding them being sometimes found growing amongst wheat and other cereal plants; and as their properties are generally regarded as deleterious, the admixture of their grains with those of the nutritious cereals should be carefully guarded against.

General Characters and Composition.—Darnel seeds when perfectly healthy have a sweetish taste, but no odour. In their other sensible properties they do not appear to differ in any evident degree from the grains generally of grasses. The recent

examination of these seeds by A. S. Wilson also show that, so far as microscopical appearances indicate, the darnel contains nothing different from the wheat. Hence in these respects there is nothing to lead to the belief generally entertained of their poisonous properties.

Darnel seeds have been frequently analysed with a view to discover the source of their supposed deleterious qualities. Thus, in 1827, by Bizio, who found a substance which he termed *lalico*, and which he stated to possess a narcotic property similar to that of opium; also, in 1837, by Muratori, who ascribed their poisonous properties to a peculiar acid; and in 1834 Bley examined them, and obtained from their watery extract a peculiar substance with an acid reaction, which he called *loliin*, and which he regarded as the poisonous principle. Two recent analyses have also been made, one by Filhol and Baillett, and the other by Ludwig and Stahl; the first experimenters give as their constituents, 50 per cent. of *starch*, *albuminoids*, and the other ordinary substances found in cereal grains; also a thick, almost concrete *green oil*, one portion of which being saponifiable, and the other not so, and insoluble in water, but very soluble in alcohol and ether; and an *extractive substance* soluble in water and alcohol. The non-saponifiable portion of the oil they describe as producing tremulousness when swallowed, but without any narcotism, and causing death in animals; and the extractive acting on animals as a narcotic. The examination of Ludwig and Stahl indicated the presence of *starch*, *gluten*, &c. They also found *two acrid oils* soluble in alcohol, but insoluble in water; and an *acrid bitter glucoside*, soluble in water; they attribute the activity of the seeds to the combined influence of these different principles. The still more recent experiments of Wittstein have convinced him "that the poisonous characters of the seeds are not due to an acid body, nor to a base, but to an indifferent body which is incapable of forming compounds with lead or zinc, and may be completely extracted from the seeds by water or alcohol, and only incompletely by ether." So far, all the above analyses of darnel grains show the presence in them of one or more poisonous

principles; but it is still open to question, as will be seen by our notice of their properties and uses, whether sufficient care has been taken to obtain healthy seeds for analyses, or in other words whether all these analyses have not been made from those in a diseased or ergotised condition.

Properties and Uses.—Darnel is usually regarded as possessing sedative and anodyne properties. It was used medicinally by the Greeks and Romans, and has also been employed in modern practice, in doses of one or two grains every four or six hours, in the form of powder or pill, in headache, rheumatic meningitis, sciatica, and other cases. But in a medicinal point of view its employment may now be regarded as obsolete; its chief interest at the present day having reference to its reputed poisonous properties.

The symptoms which darnel seeds produce on man are described by Pereira as twofold; "those indicating gastro-intestinal irritation,—such as vomiting and colic; and those which arise from disorder of the cerebro-spinal system,—such as headache, giddiness, languor, ringing in the ears, confusion of sight, dilated pupil, delirium, heaviness, somnolency, trembling, convulsions, and paralysis. These seeds, therefore, appear to be acro-narcotic poisons. According to Seeger, one of the most certain signs of poisoning by them is trembling of the whole body." Death has sometimes resulted from their use; and from the earliest times the ill-effects of darnel seeds have been testified to by numerous observers. In general these ill-effects have arisen from the intermixture of darnel seeds with other cereal grains. Thus, in a prison at Cologne, sixty persons suffered from the use of a bread-meal containing a drachm and a half of darnel in six ounces of meal; and Dr. Kingsley, of Roscrea, has also given the particulars of some cases in which several families suffered severely from the effects of bread containing by accidental admixture, the flour of darnel seeds.

The best remedies in cases of poisoning by darnel seeds are evacuants and stimulants. Thus, in Dr. Kingsley's cases just referred to, he states "that under the free use of stimulants and castor oil the whole of the patients were convalescent the

following day, but much debilitated from the effects of the poison."

Of late years, doubts have been raised whether the ill-effects of darnel are inherent in the grains themselves, or whether they are not due to their having become ergotised. Thus, Lindley says in the last edition of his 'Vegetable Kingdom,' "The noxious properties of Darnel seem to rest upon no certain proof. That formidable list of mischief belonging to its seeds of which Haller says so much, resembles what might be expected of some ergotised grass." He adds, "At all events, the properties of Darnel should be made the subject of renewed inquiry." Within the last few years this has been undertaken by A. S. Wilson, of Aberdeen, who has published the results of his valuable and interesting investigations in the 'Transactions of the Botanical Society of Edinburgh.' He states that in the course of twenty-eight days "I ate 561 grains of darnel meal, equal to about 3300 seeds, and 945 grains of darnel husks, equal to the husks of about 3100 seeds. The doses varied from 2 grains to 248. In my case, therefore (not to generalise), darnel in such doses is not justly called 'temulentum;' its seeds and husks are not 'infelix,' are not 'narcotic,' are not 'acrid,' are not 'unwholesome,' are not 'injurious,' do not cause 'delirium,' do not produce 'stupefaction,' and are not 'poisonous,' nor productive of 'fatal results.'"

Since Mr. Wilson's experiments have been published Dr. Moore, of Glasnevin, has especially referred in the 'Gardener's Chronicle' to the poisonous properties of Darnel as observed by its action on himself and others in Ireland; and other communications have appeared to the same effect in this and other journals in this country and abroad. Dr. Moore says "that scarcely a year passes over without my hearing, either directly or indirectly, of some person or persons being nearly poisoned by eating meal mixed with Darnel." Dr. Moore also refers to the common belief of its poisonous properties being more evident when eaten hot.

The experience of Dr. Moore, however, proves nothing further than that Darnel is deleterious when mixed with meal and eaten

hot, when no care had been taken to test the soundness of the grains, for he states that he had no means of knowing in what state they were when ground up with the oats, the meal of which he partook. But in the experiments of Mr. Wilson great care was taken to eat only perfectly sound darnel grains; for he found that in these grains there are other unsound substances to be rejected as well as ergot; thus, they are frequently covered with mildew and other fungi, and are also very liable to disease of a more obscure type.

The experiments of Mr. Wilson's therefore clearly prove that perfectly healthy darnel seeds have no injurious effects. But he adds, "Whether the poisonous qualities attributed to darnel resided in the ergotised seeds of this and the many other grasses which infested the ancient cornfields is a much more difficult inquiry." Further experiments upon the cause or causes which lead to the deleterious effects of darnel seeds are therefore desirable.

In speaking of Darnel, Lindley states in his 'Medical and Economic Botany' that "this is the only authentic instance of unwholesome qualities in the order of grasses," and this supposed fact in itself has been frequently cited as an argument in favour of the wholesome character of healthy darnel grains. But of late years other grasses have also had deleterious properties ascribed to them. Thus, Dr. John Shaw in a paper recently published in the 'Journal of the Linnean Society' speaks of certain parts of South Africa, which the transport riders, with their oxen, are obliged to pass over without pausing," on account of the *Melicæ* grasses which have increased to an extent scarcely to be fancied in the last few years, and on eating which cattle become affected with intoxication to an alarming extent." Dr. Hance has also very recently described a new grass, *Stipa inebrians*, which is said to intoxicate cattle in Mongolia. It is still open to question, however, whether these grasses may not owe their deleterious properties to having become ergotised, or diseased in some other way.

Gerard's Herball, by Johnson, p. 78; Steph. & Church., Med. Bot. by Burnett, pl. 3, vol. i; Per. Mat. Med,, vol. ii, pt. 1, p. 80; Christison, On Poisons; U. S. Disp., by W. & B., p. 1034; Lindley, Med. and Economic Botany, 2nd ed., p. 27; Lind., Veg. King., 3rd edit, 116 b; Le Maout et Decaisne, Traité gén. de Bot., p. 613; Journ. de Pharm., Oct., 1863, p. 280; Wittstein, in Proc. Amer. Pharm. Ass. (1876), p. 121; A. S. Wilson, in Trans. Bot. Soc. of Edinburgh, vols. xi & xii (1872-73-74); Gardeners' Chron., vol. i, N. S. (1874), p. 49; Shaw, in Journ. Lin. Soc. Bot., vol. xiv, p. 208; Hance, in Journ. Bot., 1876, p. 210.

DESCRIPTION OF PLATE.

Drawn from a specimen collected near Kew, Surrey; the fruit added from a specimen in the British Museum.

1. A plant; much reduced.
2. A spike with the uppermost leaf.
3. A flower with its pales.
4. A glume.
5. Lower pale.
6. Upper pale.
7. A flower, the pales removed.
8. Pistil.
9. Lodicules.
10. A fruiting spike of the awnless variety.
11, 12. Fruit.
13. Transverse section of the same.

(3, 5–9, 11–13 enlarged.)

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D.Blair F.L.S. ad nat. del. et lith.

M & N. Hanhart imp.

ZEA MAYS, *Linn.*

N. Ord. GRAMINEÆ.

Tribe *Phalarideæ.*

Genus **Zea,*** *Linn.* There is probably but a single species.

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296. Zea Mays,† *Linn., Sp. Plant., ed.* 1, *p.* 971 (1753).

Maize. Indian Corn.

Syn.—Z. cryptosperma, Z. hirta, &c., *Bonafous.*

Figures.—Nees, Suppl.; Berg. Characteristik, t. vi, fig. 82; Nees, Gen. Fl. Germ.; Fl. Brasil., fasc. 51, t. 11; Bonafous, Hist. Mais, tt. 1—12.

Description.—Annual. Stem 4—10 feet high, erect, stiff, not branched, solid, with a spongy central portion, quite smooth, striate. Leaves numerous, closely placed, very large; sheaths completely covering the stem, wide, smooth, striate, somewhat auriculate, and with a tuft of hairs at the apex; ligule membranous, short, truncate, laciniate; blade about 1—1½ feet long, widely spreading, linear-lanceolate, acute, undulated at the margins, which are finely ciliate at the base, smooth on both surfaces, with a strong midrib very prominent beneath. Flowers unisexual; spikelets monœcious, 2-flowered; the male spikelets numerous, in pairs, one long-stalked and one short-stalked, closely placed on the spike-like, spreading, slightly drooping branches of a large paniculate inflorescence which terminates the stem; glumes 2, nearly equal, broadly lanceolate, boat-shaped, acute or blunt, many-nerved, purplish; pales 2, nearly equal, membranaceous, shorter than the glumes, acute, the lower 3-nerved, the upper 2-nerved with the edges inflexed; female spikelets sessile or with very short pedicels sunk in the rachis, arranged in pairs in parallel longitudinal series, and very closely placed on a thick axis so as to form an oblong, cylindrical, solid, erect, nearly sessile

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* Ζειά or ζειά was the Greek name of some undetermined kind of grain, perhaps the Spelt. Linnæus adopted it for the present genus (see Hort. Cliffort., p. 437.)

† *Mays*, the native Tupi name.

spike which is surrounded by many large sheathing imbricated leafy bracts and occupies the axil of one of the lower leaves; the upper flower of the spikelet barren; glumes 2, concave, very broad and obtuse, thick and fleshy at the base, the lower emarginate, ciliate, the upper truncate; pales of the fertile flower 2, membranous, without veins, the lower one broad, blunt, like the upper glume, the upper much longer, closely wrapped round the ovary, those of the barren flower 2, thin, transparent, inflexed or involute. Male flowers:—lodicules fleshy, truncate, greenish at the base, sometimes scarious above; stamens 3, exserted, anthers orange. Female flowers:—no lodicules; ovary ovoid, smooth, sessile, style very long, about 6 inches, erect where supported by the bracts surrounding the female spike, but projecting beyond them and then drooping, filiform, flaccid, somewhat flattened, ciliate, often bifid at the end. Fruit roundish-reniform, compressed, about $\frac{3}{8}$ inch wide but varying, smooth and shining, usually bright yellow, laxly surrounded at the base by the withered glumes and pales, densely packed in vertical rows on the thickened hard axis, and forming a large, cylindrical, oblong, blunt spike surrounded and exceeded by the dry papery bracts.

Habitat.—As with several other cereals, Maize is not known in the wild state. It is, however, cultivated in all parts of the world where the climate is sufficiently warm, as throughout the Mediterranean region, Africa, the warmer parts of Asia, and especially of America, the Pacific Islands, &c. With regard to its native country and place of origin, A. De Candolle and other botanists have decided positively in favour of America, in all parts of which continent it was in common cultivation at the time of the discovery of the New World. Mexico is further suggested as the probable original centre. More recently, from researches into the literature of China, it has been shown that this grain was in cultivation in that country in the 16th century, and tradition asserts that it was introduced at a remote period from the districts bordering China on the West, facts which point towards an Asiatic origin. As far, however, as Europe is concerned, there is no doubt that the plant was brought to Spain from America

in the 16th century, and was thence carried to Italy. It was introduced into England before 1570 under the name of *Milium Indicum Plinianum* seu *Mais occidentalium*, and grows very readily, and even ripens seed in warm seasons; but it is here only grown as an ornamental garden annual.

There are many varieties cultivated, several of which are figured in Bonafous' fine memoir; the shape of the "cobs" is very diverse, and their size ranges from over a foot to only about 2 or 3 inches long; the number of rows of grains is normally 8, but there are many more in many of the cultivated varieties. The size and form of the grain also present many modifications; though usually golden yellow, the colour may be white, red, grey, purple or even nearly black, and in the same cob there are not unfrequently grains of various colours. Of the various species described, the only one which seems to have a claim to distinctness apart from *Z. Mays* is *Z. Curagua*, Molina, a native of Chili.

The upper flower of the male spikelet is frequently abortive, as in the female spikelet, or has filaments without anthers. Rarely spikes are found containing both male and female spikelets, the former occupying the lower and the latter the top part of the elongated inflorescence.

Lobel, Adversaria, p. 13; Willk. and Lange, Prod. Fl. Hisp., i, p. 35; Roxburgh, Fl. Ind., iii, p. 568; Kunth, Enum. Plant., i, p. 19; Steud., Syn. Gram., p. 9; Doell, in Fl. Brasil., fasc. 51, p. 31; Bonafous, Hist. Nat. du Mais (1836); DC., Geographie Bot., ii, p. 942; Hance & Mayers, in Pharm Journ., 1870, p. 522.

Part Used and Name.—Frumentum Indicum, Maize; the ripe grains. It is not official in the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States. It is only alluded to here on account of its value as a food substance.

General Characters and Composition.—The grains or caryopsides are roundish or somewhat kidney-shaped, and more or less flattened. They have a stony hardness, and their ordinary colour is golden yellow, but they are frequently met with of other

colours, as white, grey, parti-coloured, red, purple, and even in some cases almost black. They have no odour, but a sweetish, agreeable taste, although not usually relished at first in this country. When ground they constitute *Maize meal*, which is known commonly in the shops under the name of *polenta*. The substance called *maizena* is fine maize flour.

Maize has been analysed by Gorham, Bizio, Payen, Polson, Poggiale, and other chemists. The average results of the analysis of three varieties in an undried state by Polson, yielded in 100 parts, 54·37 *starch*, 8·83 *nitrogenous substance*, 4·50 *fat*, 2·70 *gum* and *sugar*, 15·77 *cellulose*, 12·16 *water*, and 1·67 *ash*. Poggiale found on an average in 100 parts of the dried grains, 64·5 *starch*, 6·7 *fat*, and 9·9 *nitrogenous substance*. As a general rule maize contains less nitrogenous substance than wheat, and is therefore less nutritious than it; but of all the cereal grains, maize appears to be richest in fatty matter.

Properties and Uses.—Maize possesses the nutritive properties of the cereal grains generally; but it is especially remarkable amongst them for its fattening quality, which depends on its containing a larger amount of fatty matter than any other of these grains. It is enormously used in warm countries as we use wheaten flour, but it does not make the same light spongy loaves as it, although in the form of cakes it is excellent. In those unaccustomed to its use, however, maize frequently produces, or keeps up a tendency to, diarrhœa. Polenta and maizena are also much used as food here and elsewhere. The roasted cobs or ears are sold and eaten in India, as chestnuts similarly treated are in this country. The immature ears are likewise eaten as a vegetable in some countries; and the European residents in certain of the colonies regard the tender grains as by no means a bad substitute for green peas. In South America a kind of beer called Chica or Maize Beer is made from the grain, and is extensively used; and in Western Africa a favourite fermented beverage is also prepared from Maize called *pitto* or *peto*.

In the United States and elsewhere the meal is much used in the hospitals, and makes an excellent emollient poultice. Gruel

prepared from it is also stated to be sometimes more grateful to the sick than that made from oatmeal. According to Landerer, the silky styles and stigmata are used in Greece as a decoction in diseases of the bladder.

Per. Mat. Med., vol. ii, pt. 1, p. 75; U. S. Disp., by W. & B., p. 1725; Watts' Dict. Chem., vol. i, p. 825; Daniel, in Pharm. Journ., ser. 1, vol. ii, p. 349; Polson, in Chem. Gaz., 1855, p. 211; Proc. Amer. Pharm. Assoc., vol. x, p. 121, vol. xi, p. 96, and vol. xvi, p. 202.

DESCRIPTION OF PLATE.

Drawn from a plant grown in Kew Gardens, the female flowers added from Nees.

1. Whole plant; much reduced.
2. Portion of stem with female spike.
3. Branch of male panicle and male spikelet.
4, 5. Glumes.
6. Male flower with pales.
7. Same, pales removed.
8. Female spikelets *in situ*.
9. The same seen from the side (the styles in both cut off).
10. A single spikelet.
11. The same with the glumes turned down to show the flowers.
12. Lower glume.
13. Upper glume.
14. Spike of fruit.
15, 16. Single fruits.

(4–13 enlarged.)

D.Blair F.L.S. ad nat. del et lith.

ANDROPOGON NARDUS, *Linn.*

M & N. Hanhart imp.

N. Ord. GRAMINEÆ.

Tribe *Andropogoneæ*.

Genus **Andropogon**,* *Linn.* Steudel, Syn. Gram., pp. 363–399. A very large genus, including about 500 described species, but probably many of these might be reduced.

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297. Andropogon Nardus,† *Linn., Sp. Plant., ed.* 1, *p.* 1046 (1753).

Maana (Ceylon). *Citronella Grass. Lemon Grass.*

Syn.—A. flexuosus, *Nees.* A. coloratus, *Nees.* A. Martini, *Thwaites* (not of others). A. Iwarancusa, *Roxb.* (*in part*) ?

Not previously figured.

Description.—A large perennial herb, with a long slightly branched, partly aërial rhizome, reaching ½ inch in diameter, and strongly ringed with the closely placed scars of the leaf-sheaths, the remains of which persist on the upper portion, and giving off numerous tough root-fibres. Stem reaching 6 feet or more high, erect, stout, cylindrical, solid, smooth and shining, partially concealed by the leaf-sheaths, scarcely thickened at the nodes, which are approximated below but widely separated above, flat or channelled on one side in the upper portion. Leaves very large and long, numerous, erect, lower ones sometimes reduced to their sheaths; sheaths thick and strong, about 6 inches long, close but not entirely enveloping the stem, quite smooth, striate; ligule short, brown, lacinate, scarious; blade about 2 feet long, linear, very much attenuated at the apex, tapering below, minutely denticulate with forward points on the edges, smooth on both surfaces, pale somewhat glaucous green, lighter beneath. Spikelets very small,

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* *Andropogon*, from *ἀνήρ*, a man, and *πώγων*, a beard, from the tufts of hair beneath the spikelets.

† *Nardus.* The name *νάρδος* was applied by the Greeks to certain plants yielding an aromatic oil, of which Indian nard or spikenard, *ναρδόσταχυς*, was the most celebrated. Linnæus (see his Mat. Med., p. 11) thought spikenard to be probably this grass, and others have referred it to some *Andropogon*, but Royle makes it to be the rhizome of a Valerianaceous plant of the Himalayas, *Nardostachys Jatamansi*, DC.

arranged in couples, one stalked, containing one male flower, the other sessile, with one hermaphrodite and often one barren flower; the couples, to the number of 3 or 4, articulated on alternate sides of a short, flattened, jointed rachis clothed along the edges with long white silky hairs tufted beneath the spikelets, forming a short acute spike about $\frac{1}{2}$—$\frac{3}{4}$ inch long; the spikes arranged in pairs on a common slender stalk, at the bent basal node of which is a large, erect, acute, leafy, striate, orange-red, shining bract, scarious at the edges, which encloses the pairs of spikes before expansion; the pairs of spikes very numerous, placed on the somewhat zic-zac, elongated, smooth, slender, erect, flattened branches of elongated panicles, which come off in clusters from the axils of the upper leaves, the whole forming a very large, tufted, elongated, somewhat drooping inflorescence, often 2 feet or more in length; glumes nearly equal, acuminate, membranous, smooth, purplish, boat-shaped, the lower one of the sessile spikelet flattened on the back against the rachis and without a midrib, those of the stalked spikelets with several parallel strong veins; pales of the lower spikelet 2, or with a third representing a barren flower, very unequal, the lower very small, deeply bifid with two long cusps, from between which comes off a long, slender, slightly kneed purple awn, about twice the length of the glumes, and projecting considerably beyond the spikelet, the upper much larger, acute but without an awn, very delicate and membranous, without veins; in the flower of the upper spikelet there is but a single membranous non-awned pale. Lodicules 2, oblong, truncate, longer than the ovary. Stamens 3, anthers purple. Stigmas 2, spreading, protruded from the flower, plumose, bright red-purple. Fruit not united with the pales.

Habitat.—This beautiful grass is a native of Ceylon, where it grows up to the level of 3000 feet; in parts of the Madras presidency of continental India it is also found abundantly (as about Travancore), but it is doubtful whether it is met with further to the north. It is rather extensively cultivated about Galle in Ceylon and at Singapore.

Plants have been grown at Kew for many years, but there is no

record as to the source whence they were derived. The cultivated plant from which our drawing was made is very much more lax than in the typical specimens of Hermann's herbarium (now in the British Museum) upon which Linnæus founded the species, and the awns are much longer; indeed, in this and other specimens the awns are entirely included within the glumes; but both of these characters are variable, Thwaites' specimens being intermediate between the Kew and Hermann's plants in each particular.

The best characters for distinguishing *A. Nardus* from allied species, according to General Munro, to whose notes—the result of great research and kindly placed at our disposal—we are much indebted, are to be found in its rufous colour, short spikes and narrow leaves.

There is still great confusion amongst the species of Andropogon affording grass oils. *A. Schœnanthus*, Linn., the Ginger-grass of North and Central India, is the best known and most widely distributed. This is the true *A. Martini*, Roxb. and *A. pachnodes*, Trin., and has been figured by Trinius (Sp. Gram. III., t. 327). It is cultivated in Bombay, and also in Jamaica and Mauritius, and is not uncommon in gardens throughout the tropics. A Himalayan form of this was considered by Royle to be certainly the "Calamus aromaticus" of the ancients, and this he has figured in his Ill. Bot. Himal. (t. 97) under the name of *A. Calamus-aromaticus*. This formerly valuable substance has been referred by others to *Acorus Calamus*, L. (see no. 279). The spice called "Calamus" and "Sweet Cane" in the English version of the Bible, one of the ingredients of the holy anointing oil of the Jews, may have been one of these fragrant Andropogons, but Hanbury thinks it more probably referable to Cassia bark.

A. citratus, DC., the Lemon grass, is less known. It only occurs in a cultivated state and very rarely flowers. In Ceylon and Singapore it is grown along with *A. Nardus*; and is cultivated in gardens for its foliage in other hot countries. The leaves are more glaucous than in the last. According to Munro, it is the plant figured as *A. Schœnanthus* in Wallich's Plant. Asiat. Rar., t. 280.

A. laniger, Desf. (*A. Olivieri*, Boiss.) has a very extensive distribu-

tion throughout Northern Africa from Algeria to Egypt, and extends through Arabia and other desert regions to Northern India. This species is the "Schœnanthus" or "Juncus odoratus" of the pharmacists, which has been long known. The plant is figured in Trinius' Icones Gram., t. 326; it is probable also that the *A. Iwarancusa* of Roxburgh, as shown by his specimens, is to be referred to it, as well as Blane's "Spikenard" figured in his paper in the 'Philosophical Transactions,' of which is an authentic specimen in the British Museum.

All these species belong to the section of *Andropogon* called *Cymbopogon*, distinguished by the large bracts and by the venation of the glumes. There are about 40 species described.

Linnæus, Fl. Zeylanica, p. 18; Roxb., Fl. Indica, i, p. 274, 280; Blane, in Phil. Trans., lxxx (1790), p. 284; Royle, Ill. Himalayan Bot., p. 425; Kunth, Enum. Plant., i, p. 493; Lindl. Fl. Med., p. 612; Flück. & Hanb., Pharmacogr., p. 660.

Official Part and Names.—Oleum Andropogi Nardi: the volatile oil obtained by distillation from the fresh plant (I. P.).

The volatile oils obtained by distillation from the fresh plants of Andropogon citratus, *DC.* (*Oleum Andropogi citrati*); and of Andropogon pachnodes, *Trin.* (A. Schœnanthus, *Linn.*), are also official in the Pharmacopœia of India. These oils are not official in the British Pharmacopœia, or the Pharmacopœia of the United States.

These oils are commonly known under the general name of *Grass oils* or *Indian Grass oils*. The oil of *Andropogon Nardus* is also specially distinguished as *Citronella oil* or *Oil of Citronelle*; that of *A. citratus* as *Lemon Grass oil, Oil of Verbena,* or *Indian Melissa oil,* and in Java under the name of *Sireh*; that of *A. pachnodes* as *Rúsa oil, Oil of Ginger Grass, Oil of Geranium,* or sometimes as *Grass oil of Nimár* or *Namur*.

Production and Commerce.—*Andropogon Nardus* and *A. citratus* are largely cultivated in Ceylon and Singapore; and *A. pachnodes* in Northern and Central India, for the distillation of their respective volatile oils. The consumption of these oils has very much increased of late years.

General Characters.—Grass oils vary somewhat in colour, that of Oil of Citronelle being commonly light greenish-yellow; that of Lemon grass oil from a pale sherry colour to deep golden brown; and that of Oil of Ginger grass from pale greenish-yellow to yellowish-brown. They have all an extremely pungent taste; and a very fragrant odour, resembling a mixture of rose and lemon. Lemon grass oil also receives the name of Oil of Verbena from its odour strongly resembling the sweet-scented Verbena or Lemon Plant of our gardens (*Lippia* (*Aloysia*) *citriodora*); and Oil of Ginger Grass is called Oil of Geranium, from its odour resembling the true oil of geranium derived from *Pelargonium Radula*, Ait. All these oils are devoid of rotatory power, are lighter than water, and have no action on litmus paper.

Medical Properties and Uses.—Grass oils have acquired some reputation in India for their stimulant, carminative, antispasmodic, and diaphoretic effects, when administered internally; and are in high repute when locally applied, as rubefacients. They have been employed with some success, more particularly Lemon grass oil, in flatulent and spasmodic affections of the bowels, and in gastric irritability; and Waring states, that in cholera, Lemon grass oil "proves serviceable, not only by allaying and arresting the vomiting, but by aiding the process of reaction." For external application these oils should be diluted with about twice their bulk of soap liniment or olive oil, and they then form valuable embrocations in chronic rheumatism, neuralgia, sprains, and other painful affections. Oil of Ginger grass is also said to stimulate the growth of the hair.

A warm infusion of the leaves of *Andropogon citratus* is likewise stated to be a valuable diaphoretic in febrile affections. The fresh leaves of the same plant are also sometimes used as a substitute for tea; and the centre of the stem for flavouring curries, &c.

The principal consumption, however, of these oils is in Europe and the United States, where they are largely used by the perfumer and soapmaker. Rúsa oil, called in Hindustani, *Rusa ka*

tel, is also very extensively employed in European Turkey, for adulterating *Attar of Rose,* as is mentioned by us in describing "Rosa centifolia."

Per. Mat. Med., vol. ii, pt. 1, pp. 132–136; Pharmacographia, p. 660; Pharmacopœia of India, pp. 255 and 464; Stenhouse, in Pharm. Journ,, vol. iv, ser. 1, p. 276; Hamilton, in Pharm. Journ., vol. vi, ser. i, p. 369; Guibourt, Hist. Nat. des Drogues, 4me édit., t. 2, p. 114.

DESCRIPTION OF PLATE.

Drawn from a plant in Kew Gardens flowering in May.

1. A portion of the inflorescence.
2. A couple of spikelets.
3. A joint of the rachis.
4. Glumes of the lower spikelet.
5. The lower glume.
6. Pales of the lower spikelet.
7. Stamens.
8. Lodicules and pistil.
9. The upper spikelet opened.
10. A leaf.
11. Base of stem and rhizome.

(2–9 enlarged.)

5

D Blair F.L.S. ad. sicc. del. et lith.

M & N. Hanhart imp.

SACCHARUM OFFICINARUM, *Linn.*

N. Ord. GRAMINEÆ.

Tribe *Andropogoneæ*.

Genus **Saccharum**,* *Linn.* Kunth, Enum. Pl., i, p. 575. Species (including *Erianthus*) about 50, natives of the warmer portions of both worlds.

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298. Saccharum officinarum, *Linn., Sp. Plant., ed.* 1, *p.* 54 (1753).

Sugar-cane.

Figures.—Woodville, t. 266; Tussac, Fl. Antilles, i, tt. 23—25, cop. in Hayne, ix, tt. 30, 31, and Nees, t. 33—35; Steph. & Ch., t. 148; Hook., Bot. Miscell., i, t. 26.

Description.—A very large perennial herb, with a thick, solid, jointed rhizome, giving off root-fibres above each joint. Stems numerous, erect, attaining a height of from 6 to 12 feet or more, cylindrical, solid, succulent within, with numerous joints at a distance of $1\frac{1}{2}$—3 inches, the internodes shorter at the base, slightly swollen, about $1\frac{1}{2}$ inch in diameter, smooth, shining and polished, yellow, purple, or striped, not branched, but with a bud at each node, and with numerous scar-like dots arranged in 3 irregular rings above each node, from which at the lower ones proceed root-fibres. Leaves very large, numerous, distichous, closely placed, soon deciduous from the lower part of the stem, sheaths a foot long, rather close, striate, smooth or with white farinose pubescence which is easily removed, ligule very short, entire, blade 3 feet or more long, at first erect, then spreading, 3 inches or more wide, acute, very finely serrulate on the margin, smooth on both surfaces, ciliate on the sides at the base with long, erect white hairs, central vein wide and thick, prominent on the back. Spikelets small, very numerous, 1-flowered, all hermaphrodite, arranged in pairs, one being sessile, the other stalked, each surrounded by a dense ring of long, white, straight, spreading

* *Saccharum*, in Greek σάκχαρ or σάκχαρον, the name of sugar in Pliny and Dioscorides; words of Sanskrit origin.

silky hairs, arising immediately below and coming away with the spikelet; the couples placed rather distantly on alternate sides of the very long, slender, erect or curved, straight or flexuose, smooth branches of greatly elongated narrow panicles, which are themselves branches (angular, villous at the base) given off in irregular whorls of 6—8 from the stout, erect, smooth, obtusely angled rachis, the whole forming a very large, feathery, somewhat drooping, terminal, grey inflorescence, 2 feet or more in length; glumes 2, nearly equal, oblong-lanceolate, acute, not awned, membranaceous, the lower 2-nerved, somewhat ciliated at the upper part, the upper 1-nerved, slightly keeled; pale solitary, enclosed in the upper glume than which it is slightly shorter, membranous, pink, ovate-lanceolate, rather obtuse, quite smooth, without veins. Lodicules 2, free, truncate, 2—3-lobed or torn. Stamens 3, anthers linear-oblong, pale yellow. Ovary smooth, styles 2, spreading, the upper portion densely plumose, dark purple. Fruit not seen.

Habitat.—If the wild form of the Sugar-cane is to be anywhere now met with, it is in India, of which country it is undoubtedly a native, and where it has been cultivated from the earliest antiquity. Whether the species grown in China, *S. chinense*, Roxb., is specifically the same is scarcely determined with certainty, but it is probably native in that country. The culture of the plant spread westward in the early middle ages to Persia, and was carried by the Arabs to the Mediterranean districts, Sicily, Cyprus, Spain, and Italy. It quickly spread over other parts of the globe, and in the New World was introduced to S. Domingo as early as 1494, and into Brazil early in the 16th century. At the present day the cane is grown in all suitable countries throughout the world, and especially in the West Indies, Mauritius, British Guiana, &c. The only part of Europe where the culture is still continued is near Malaga on the Mediterranean coast of Spain. The Sugar-cane is grown in stoves in this country, but does not flower here.

There are many varieties recognised by cultivators, depending on the thickness, texture, and colour of the stems, of which an account is given in Tussac's work quoted below.

The grain appears to be rarely produced, and we have not found mature specimens in the herbarium. It is said never to ripen seed in Jamaica. The spikelets are often described as 2-flowered, but there was but a single flower in the specimens examined.

Roxburgh, Fl. Indica, i, p. 237; Kunth, Enum. Plant., i, p. 475; Steudel, Syn. Gram., p. 405; Macfadyen, in Hook. Bot. Misc., i, p. 95 (1830); DC. Géogr. Bot., p. 836; Lindl., Fl. Med., p. 613; Flück. and Hanb., Pharmacogr., p. 649; Tussac, Fl. Antilles, i, p. 151.

Official Parts and Names.—1. SACCHARUM PURIFICATUM; pure cane sugar prepared from the juice of the stem: 2. THERIACA; the uncrystallised residue of the refining of sugar (B. P.). 1. Pure cane sugar prepared from the juice of the stem: 2. The uncrystallised residue of the refining of sugar (I. P.). 1. SACCHARUM; the sugar of Saccharum officinarum, refined: 2. SYRUPUS FUSCUS, *Molasses;* the impure, dark-coloured syrup, obtained in making sugar from Saccharum officinarum (U. S. P.).

1. SACCHARUM PURIFICATUM, or SACCHARUM.—Before describing the characters of Refined Sugar it will be necessary to allude briefly to the mode of obtaining Raw Sugar, and the process of Sugar Refining.

Preparation of Raw Sugar.—The ripe canes are cut close to the ground, stripped of their leaves, and subjected to pressure between iron rollers, or in some other suitable way. The cane juice thus obtained, is clarified by the combined use of lime and heat. The heat coagulates any albumen which may be present; and the lime neutralises the free acid, and combines with a peculiar albuminous body not coagulable by heat or acids, and forms with it a coagulum, the separation of which is promoted by the heat. Part of it rises to the top as a scum, and the remainder subsides. The clarified juice is then drawn off into the boiler, evaporated and skimmed. When it has acquired a proper tenacity and granular aspect, it is emptied into a cooler and allowed to crystallise or *grain.* The concrete sugar is then placed in casks perforated with holes in the bottom; and the sugar is left to drain for three or four weeks. It is then packed in hogsheads,

and exported under the name of *raw* or *muscovado sugar*. The drainings or uncrystallized portion of sugar, constitute *molasses*.

Sugar Refining.—Raw sugar is a mixture of crystallizable and uncrystallizable sugar, contaminated by various organic and inorganic substances. It is refined as follows :—It is first dissolved in water by the aid of steam ; the liquid is then heated with bullock's blood and filtered through canvas bags ; and the clear liquor afterwards allowed to percolate slowly through enormous cylinders containing coarse-grained animal and fresh burnt charcoal. The filtered liquor, which is nearly colourless, is then boiled by the aid of steam, under diminished atmospheric pressure, at a temperature of about 170°. When the requisite degree of concentration has been attained, the syrup is transferred to conical moulds whose orifices are closed ; and when the contents have solidified, the stoppers are withdrawn from the orifices, and the moulds are placed in pots in order to allow the *treacle* to drain off. The loaves are then *sugared* by pouring on their base a saturated syrup, which by slowly percolating through the mass, carries with it the colouring matter and other impurities, but does not dissolve the crystallized sugar.

General Characters.—Refined sugar is in compact, crystalline, conical loaves, known in commerce as loaf sugar. Refined sugar is snow-white, dry, inodorous, intensely and purely sweet, porous, friable, and made up of small crystalline grains. It is permanent in the air, melts when heated, and soon becomes coloured under such circumstances ; and when subjected gradually to a high temperature, it becomes brown, evolves a remarkable odour, loses its sweet taste, acquires a bitter one, and then constitutes what is called *caramel* or *burnt sugar*. Cane sugar is soluble in both hot and cold water ; and also soluble in rectified spirit, but insoluble in ether. Its watery solutions aided by heat, decompose some of the metallic salts. A dilute watery solution with a little yeast undergoes the vinous fermentation. The aqueous solution produces a right-handed rotation on a ray of polarised light. By the slow cooling of a saturated aqueous solution of sugar we obtain the large and fine crystals, which constitute the commercial *sugar*

candy; these crystals are four-sided oblique rhombic prisms, with dihedral summits. Sugar fuses at 320°, and on cooling assumes the viscous condition, in which it is known as *barley sugar*. Sugar promotes the solubility of lime in water; and forms both an insoluble and soluble compound with oxide of lead.

Medical Properties and Uses.—Sugar is of little importance in a medical point of view. In the form of lozenges, sugar candy, &c., it allays tickling cough by slowly dissolving in the mouth. It is nutritious, but in consequence of not containing nitrogen, it is not capable in itself of supporting life. It is a powerful antiseptic, and is largely used for preserving meat and fruit. The popular notion that sugar is injurious to the teeth is unfounded, as a solution of sugar has no action on the teeth. In pharmacy, sugar serves to preserve; to give flavour, bulk, form, cohesiveness and consistence; to subdivide, and to suspend oily substances in aqueous fluids; and to preserve some inorganic compounds, hence its use in the syrup of iodide of iron, and saccharated carbonate of iron.

The consumption of sugar in this country otherwise than for its medicinal and pharmaceutical uses is enormous, the average imports being not less than 15,000,000 cwt.

2. Theriaca, *Treacle.* Syrupus Fuscus, *Molasses.*—Treacle and molasses are thick, dark brown, fermentable liquids, composed of uncrystallizable sugar, crystallizable sugar, various salts, gummy and colouring matters, water &c. They are frequently confounded together, but *molasses* is the drainings from raw or muscovado sugar; while *treacle* is that which drains from refined sugar in the sugar moulds. Molasses is sometimes termed *Golden Syrup.* In the United States two kinds of molasses are distinguished under the names of *West India Molasses* and *Sugar-house Molasses.* The former is the molasses of this country; and the latter our treacle. Treacle has a darker colour than molasses, is thicker, and has a somewhat different flavour; it is very sweet, does not crystallise by rest or evaporation, and has a specific gravity of about 1·40. It should be free from a burnt odour or taste.

Medical Properties and Uses.—Treacle is slightly laxative. It

is used in pharmacy to give cohesiveness to pill masses, to preserve them in a softened state, to prevent mouldiness, and to some extent to check chemical changes.

Both treacle and molasses are capable of fermentation by yeast; and then by distillation yield rum.

Per. Mat. Med., vol. ii, pt. 1, p. 121; Per. Mat. Med., by B. & R., pp. 410 & 413; Pharmacographia, p. 652; Cooley's Cyclopædia, p. 1087; U. S. Disp., by W. & B., p. 754; Watts, Dict. Chem., vol. v, p. 468; Royle, Mat. Med., by J. Harley, p. 319.

DESCRIPTION OF PLATE.

The reduced figure of the whole plant copied from Macfadyen, the stem and leaf from Tussac, the flowers from specimens in the British Museum collected in Mauritius.

1. The whole plant (about $\frac{1}{12}$ nat. size).
2. Portion of stem.
3. Portion of stem with leaves.
4. Portion of inflorescence.
5. A pair of spikelets.
6. A stalked spikelet.
7. The pale—8. The lower—and 9. The upper glume.
10. The flower.

(5–10 enlarged.)

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N. Ord. LYCOPODIACEÆ. Lindl., Veg. Kingd., p. 69. Le Maout & Dec., p. 911.

Genus **Lycopodium**,* *Linn.* Species over 100, natives of all parts of the globe.

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299. Lycopodium clavatum, *Linn., Sp. Plant., ed.* 1, *p.* 1101 (1753).

Common Club-moss. Stagshorn.

Syn.—L. inflexum, *Sw.*

Figures.—Hayne, viii, t. 47; Nees, t. 13; Berg & Sch., t. 28 a; Sow., Eng. Bot., t. 224; Fl. Danica, t. 126.

Description.—A perennial plant, with prostrate, creeping, very slender, tough and flexible, woody stems, extending to a great length (even 30 feet or more), but not increasing in diameter, much branched in a dichotomous manner, the branches short, ascending, giving off at intervals from the under surface solitary, straight, simple, wiry, pale yellow roots. Leaves very numerous, small, persistent for many years, about $\frac{1}{4}$ inch long, very closely placed all over the stem and densely imbricated, the points all turned somewhat upwards, sessile, linear-oblong, acute, the apex terminating in a hair-like process often as long as the leaf, smooth, one-veined, dry, pale yellow-green, the hair-points reddish. Fructification contained in cones which are borne singly or more usually in pairs, at the extremity of erect slender stiff branches set with smaller, thinner, more distant, paler leaves without a hair point; cones about 1—2 inches long, cylindrical, linear, blunt, composed of an axis and very many closely placed, strongly imbricated bracts which are shortly stalked, triangular-ovate, terminated by a long filiform point and slightly produced at the base below the stalk so as to be somewhat peltate, faintly denticulate at the margins, sulphur-yellow, at first erect, but somewhat spreading after the discharge of the spores. Spores very minute,

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* *Lycopodium*, from λύκος, a wolf, and πούς, a foot, wolf's claw; a mediæval name; from the form of the short leafy shoots.

bluntly tetrahedral, finely reticulated, pale yellow, contained, very many together, in small strong, reniform cases (sporangia) which open by a fissure along their whole length and are attached, by short thick stalks, one at the base of the inner surface of each bract of the cone.

Habitat.—This curious plant has a very extensive distribution over the globe, being found in the temperate and colder regions of both hemispheres and in the Old and New Worlds. It occurs in healthy and hilly districts throughout Europe, Northern Asia and North America, extending to within the Arctic circle and to the Himalayas. It also grows in Australia, at the Cape of Good Hope, and in the Falkland Islands, and in Madagascar, Java, Japan and tropical America.

In this country it is frequent in suitable situations, but is far more abundant in the north than the south, where it has become extinct in many places. The cones are produced in July and August, and are in some years very abundant and in others scarcely to be met with.

Spring, who has monographed this Order, gives nine distinct varieties of this nearly cosmopolitan plant.

The club-mosses, like the Ferns, are asexual plants. The development of the spores of *L. clavatum* has not been traced as yet, but those of *L. inundatum* are known to form a prothallus, and in *L. annotinum* the prothallus has been observed to be subterranean, with rootlets from the under surface and the male (antheridia) and female (archegonia) organs on the upper; from the latter of these, after fertilization by the former, the plant is produced.

The spores of nearly allied species are quite similar in structure and properties to those of *L. clavatum*.

Hook. f., Stud. Fl., p. 470; Watson, Comp. Cyb. Brit., p. 417; A. Gray, Man. Bot. N. U. States, p. 674; Ledebour, Fl. Ross., iv, p. 499; Spring, Mon. des Lycop., i, p. 88.

Official Part and Name.—LYCOPODIUM; the sporules of Lycopodium clavatum, and of other species of Lycopodium (U. S. P.).

It is not official in the British Pharmacopœia, or the Pharmacopœia of India.

Collection.—Lycopodium is collected by cutting off the tops of the plants when the spikes or cones of fruit are nearly mature, and the sporules or spores are subsequently shaken out of the sporangia, and then separated from extraneous substances by a sieve. Lycopodium is chiefly collected in Germany, Russia, and Switzerland, in the months of July and August.

General Characters and Composition.—Lycopodium, or as it is frequently termed *vegetable sulphur,* is a very fine mobile powder, without odour or taste, and of a pale yellow colour. It is very inflammable, but burning slowly under ordinary circumstances; if, however, it is thrown into flame it burns with rapidity and explosively, producing an instantaneous flash of yellowish-white light. It floats when strewed on the surface of water, and is wetted with difficulty; but it is readily miscible with oily and alcoholic liquids, ether, or chloroform.

The principal constituent is a *fixed oil,* which is found in the very large proportion of 47 per cent. It is described as a bland liquid which maintains its liquidity even at the low temperature of 5° above the zero of Fahrenheit.

Adulterations and Substitutions.—Lycopodium is frequently adulterated, and even in some cases, other substances have been substituted for it. Thus the pollen of *Pinus sylvestris* and of other Coniferæ, and that of other plants has been substituted for it. The best means of detection in such cases is the microscope, the spores being readily distinguishable by their peculiar structure from all kinds of pollen, and indeed, from all other substances. Pine pollen is also less fine and mobile, and mixes more readily with water than lycopodium. *Starch, dextrin, flour, powdered resin, talc, French chalk, gypsum,* and other matters, have also been noticed as adulterants. The microscope is a ready means of detection; but starch, dextrin, and flour may be also easily recognised by their well-known and appropriate tests; and inorganic matters such as talc, gypsum, magnesia, chalk, &c., by incineration, the ash of lycopodium only amounting to 4 per

cent. Inorganic matters also commonly sink in water; whilst lycopodium floats on the surface of that liquid.

Medical Properties and Uses.—In medicine lycopodium is employed as a dusting powder to excoriated surfaces, as in the intertrigo of infants, and in eczema, erysipelas, &c. In pharmacy it is used for enveloping pills, in order to prevent their adhesion, and cover their taste.

The chief use of lycopodium is, however, for producing artificial lightning at the theatres, and by the pyrotechnist.

Formerly both the spores and herb were employed internally in retention of urine, plica polonica, calculous complaints, and other diseases; but they have now entirely fallen into disuse.

Per. Mat. Med., vol. ii, pt. 1, p. 67; Pharmacographia, p. 665; U. S. Disp., by W. & B., p. 535; Chicago Pharmacist, Sept., 1873; Proc. Amer. Pharm. Assoc., 1862, 1863, 1868, 1873, 1874, and 1875; Amer. Journ. Pharm., 1875, p. 26; Rep. de Pharm., 1873, p. 630, with figures.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected in Yorkshire.

1. Middle portion of a stem with branches and cones.
2. A leaf.
3. A cone-scale.
4. Inner view of the same with sporangium.
5. Section of the same.
6. Spores.

(2–5 enlarged, 6 greatly magnified.)

D.Blair F.L.S. ad nat. del et lth.

ASPIDIUM FILIXMAS, *Swartz.*

M & N. Hanhart imp.

N. Ord FILICES. Lindl., Veg. Kingd., p. 78; Le Maout & Dec., p. 893.

Tribe *Polypodiaceæ*.

Genus Aspidium,* *Swartz.* Includes *Nephrodium, Lastrea,* &c., and contains about 300 species, natives of all parts of the world.

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300. Aspidium Filix-mas,† *Swartz, Syn. Fil., p.* 55 (1806).

Male Fern.

Syn.—Polypodium Filix-mas, *Linn.* Lastrea Filix-mas, *Presl.* Nephrodium Filix-mas, *Michx.* Dryopteris Filix-mas, *Schott.*

Figure.—Woodville, t. 267; Nees, t. 19; Berg & Sch., tt. 32 e & f; Hook., Curt. Fl. Lond., iv; Moore & Lindl., Ferns, tt. 14—17.

Description.—A perennial herbaceous plant, with a short, unbranched, subterranean rhizome about an inch in diameter, but apparently about $2\frac{1}{2}$ inches, being entirely covered and concealed by the numerous hard, persistent, imbricated, dark-brown bases of the fronds, which are at first densely covered with numerous elongated, scarious, transparent, golden-brown, chaffy scales (ramenta), but afterwards bare; roots very numerous, filiform, cylindrical, long, slightly branched, dark brown, passing outwards from the rhizome between the frond-bases. Fronds (leaves) large, several, 2—3 feet long or rather more, arising from the extremity of the rhizome, erect, somewhat curved outwards, and forming collectively a spreading plume, on long, stout, stiff, strongly channelled, pale brown stipes (petioles), at first closely covered for their whole length with numerous acute, chaffy, thin, transparent, pale-brown scales and hairs of various sizes and shapes, which soon fall off from the upper part, blade oblong-ovate or oval in outline, tapering to the apex, bipinnate or pinnate, rachis stiff, channelled, pale brown, with scattered hairs, pinnæ (leaflets)

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* *Aspidium*, from ἀσπίς, a round shield; referring to the indusium.

† *Filix-mas*, male fern, the mediæval botanists' and pharmacists' name for this species.

alternate, very numerous, overlapping or separate, nearly sessile, linear-oblong in outline, truncate at the base, tapering and acute at the apex, diminishing in length up the rachis and at length confluent at its end, very deeply cleft nearly or quite to the mid-rib into numerous contiguous, sessile, broad based, broadly oblong, obtuse segments or separate leaflets, crenate or nearly entire on the sides, finely crenate-serrate at the ends, somewhat convex above, smooth on both surfaces, venation forked or simple; before expansion the whole frond is strongly rolled in on itself (circinate) and forms a compact crozier-shaped body. Fructification consisting of exceedingly minute (asexual), ovoid, brown spores, a number of which are contained within very minute, ovoid, somewhat compressed, blunt, membranous cases (sporangia), which possess, along $\frac{3}{4}$ or more of their circumference, an elastic longitudinal ring, which causes an irregular transverse dehiscence allowing the escape of the spores; sporangia stalked, attached, many together, at a common point to form a circular group (sorus), which is covered by a circular-reniform, membranous, smooth cover (indusium) attached at the central depression of its notch; sori numerous, placed at definite points on the veins on the back of the segments of the pinnæ, and forming a single row on either side of the midrib, usually in the lower half or three quarters.

Habitat.—This is one of our commonest ferns; after the Bracken, indeed, the species most frequently met with in England, and a familiar ornament to woods and shady hedgebanks. It has a very wide range over the world, growing in all parts of Europe, temperate Asia, Northern India, Northern and South Africa, the temperate parts of the United States, and the Andes of South America. The numerous varieties presented over this extensive area have received names for which reference must be made to special treatises. The forms of the male fern in this country alone are considerable, the most marked being *affine, Borreri, pumilum, abbreviatum, and elongatum.*

The genus *Nephrodium* differs from *Aspidium* as often now restricted, merely in the reniform shape of the indusium.

It will be seen from the above description that the fern possesses

no male and female organs, but produces spores asexually. The true reproductive organs of all ferns are found on a body called the *prothallus*, a minute flat, cellular, somewhat kidney-shaped plant developed by the germination of the spores above described. Upon the under surface of this, near the concave edge, are found the female organs (archegonia), and among the rootlets, near the convex edge, are the male organs (antheridia). The young fern grows from the central cell of the archegonium after its fertilisation by the spermatozoids of the antheridium. Ferns thus afford very marked examples of "alternation of generations."

Hooker, Species Filicum, iv, p. 116; Hook. & Baker, Synopsis Fil., p. 272; Moore & Lindl., Ferns of Gt. Britain, nature painted; Hook. f. Stud. Fl., p. 465; Newman, Hist. Brit. Ferns, ed. 3, p. 183; Lindl., Fl. Med., p. 619.

Official Parts and Name.—Filix Mas; the dried rhizome with the bases of the footstalks and portions of the root fibres (B. P.). The dried rhizome, with the bases of the footstalks and portions of the root fibres (I. P.). Filix Mas; the rhizome covered with portions of the leafstalks or stipes (U. S. P.).

Collection and Preservation.—In the British Pharmacopœia and in the Pharmacopœia of India, male fern is directed to be collected in the summer; and in the Pharmacopœia of the United States it is ordered that "when used, only such part of the rhizome as has retained its green colour should be employed; and the stipes, being inert, should be removed." M. Peschier, of Geneva, also recommends male fern to be collected in the summer, as he states it abounds then more than at any other time with the active principle. He also says, and this is in accordance with the results of subsequent observers, that it deteriorates rapidly when kept, and that in about three years it becomes entirely inert. But Hanbury and Flückiger recommend, that "for pharmaceutical use, it should be collected in the late autumn, winter, or early spring, divested of the dead portions, split open, dried with a gentle heat, reduced to coarse powder, and at once exhausted with ether. Extract obtained in this way is more efficient than that which has been got from rhizome that has been kept for some time."

According to our experience also, the late autumn is the best time for collecting the rhizome. Geiger says, that after collection the black discoloured portions should be cut away, the root fibres and all scales removed, and the inner parts of the rhizome, and of the portions of stalks attached to it, which are fleshy and of a light yellowish-green colour, should alone be preserved. These, he says, should be immediately and carefully dried, then pulverised, and the powder kept in well-stoppered bottles. The rhizome should be dried as quickly as possible in the open air in the shade, or in a hot-air press at a temperature not exceeding 140°.

General Characters and Composition.—The rhizome varies in length and thickness according to its age. Pereira says that for medical purposes "it should be from three to six or more inches long, and from half an inch to an inch or more broad." When removed from the ground in the autumn the caudex is cylindrical and covered with the closely arranged and overlapping remains of the leaf-stalks of the decayed fronds. These stalks are from one to two inches long, somewhat curved, angular, and brown coloured; and surrounded at the base with thin silky scales of a light-brown colour. From between these remains of the petioles or leaf-stalks the black wiry branched roots may be seen. Internally, as thus found in the fresh state, the rhizome is fleshy, and of a light yellowish-green colour; it has very little odour, but a sweetish, astringent, and subsequently nauseous and bitter taste. As seen in the pharmacies in a dried state male fern is commonly broken up into fragments, which consist of the separated thickened bases of the leaf-stalks, to which small portions of the rhizome are attached at their base, and surrounded by the small silky scales. Dried fern rhizome has a brownish colour externally, and is yellowish-white or brownish internally. The odour is feeble but disagreeable; and the taste sweetish, astringent, and subsequently bitter and nauseous.

Fern rhizome has been analysed by Geiger, Bock, Luck, and other chemists, and has been found to contain, in addition to *starch, gum,* and *salts,* from 5 to 6 per cent. of a *green fatty oil,* a little *volatile oil, resin, tannin,* and *crystallizable sugar.* The

active properties are soluble in ether, and the ethereal extract deposits a colourless, granular, crystalline substance, which has been designated *filicic acid*. This *filicic acid* is regarded by Buchheim as the source of the medicinal activity of the drug. The official liquid extract of Fern, which is commonly termed *oil of male fern*, is of a dark-green colour, and contains in solution the fatty and volatile oil, the resin, and the colouring matter of the rhizome. The rhizome yields about 8 per cent. of this ethereal extract.

Substitution.—The rhizomes of *Asplenium Filix-fœmina*, Bernh., *Aspidium Oreopteris*, Sw., and *Aspidium spinulosum*, Sw., which resemble that of the Male Fern, are best distinguished, according to the authors of Pharmacographia, by examining the transverse sections of their leaf-bases by a magnifying lens. Thus in *Filix-mas*, the section exhibits 8 vascular bundles, whilst in the three other ferns named, only 2 can be observed.

Medical Properties and Uses.—Male fern has long been known as a valuable anthelmintic. It is generally supposed to kill the worms and thus aid their expulsion from the intestinal canal; but J. Harley says, it does not destroy the entozoon, but that it detaches it from the coats, and also casts it out, of the bowels by the force of the peristaltic contractions which it produces. It should be given on an empty stomach, and the best form for its administration is the official liquid extract; and after an interval of about two hours a dose of castor oil or some other mild purgative should be given. It is especially valuable in cases of tapeworm; and recent observations also prove that, contrary to what has been sometimes stated, it is entirely efficacious in the three kinds of tapeworm respectively termed *Bothriocephalus latus*, *Tænia solium*, and *Tænia medio-cannellata*. Garrod says, that "upon the whole, liquid extract of male fern is perhaps the most valuable and most extensively employed of any anthelmintic in this country for the removal of tapeworms, and the small bulk of the dose is a great desideratum." It is also much employed for a similar purpose by the veterinary practitioner.

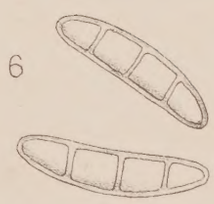
Per. Mat. Med., vol. ii, pt. 1, p. 62; Per. Mat. Med., by B. & R., p. 402; Pharmacographia, p. 667; U. S. Disp., by W. & B., p. 409; Garr., Mat. Med., p. 393; Royle, Mat. Med., by J. Harley, p. 370; Tuson, Veterinary Pharmacopœia, p. 107; Bock, in Amer. Journ. of Pharm., vol. xxiv, p. 64; Luck, in Chem. Gaz., vol. ix, pp. 407 & 452; Ronzel, Journ. de Pharm., 3e sér., iv, 474.

DESCRIPTION OF PLATE.

Drawn from specimens collected in Kew Gardens and at Ben Lomond, Scotland; the prothallus added from Berg & Schmidt.

1. Terminal portion of a leaf.
2. Under surface of a segment.
3. Indusium.
4. Sporangium and spores.
5. Spores, more magnified.
6. Portion of rhizome.
7. Prothallus.
8. Antheridium.
9. Archegonium.

(2, 3 enlarged; 4, 5, 7–9 much magnified.



D.Blair F.L.S. ad sicc. del. et lith.

ROCCELLA TINCTORIA, *DC.*

M & N. Hanhart imp.

N. Ord. LICHENES. Lindl. Veg. Kingd., p. 45. Le Maout & Dec., p. 940.

Tribe *Roccellei.*

Genus **Roccella,*** *DC.* Nylander, Syst. Meth. Lich., i, p. 257. There are about 6 species, found in warm and temperate parts of both hemispheres.

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301. Roccella tinctoria, *DC., Flore Française,* ii, *p.* 334 (1805).

Orchella weed. Dyer's weed. Rock moss.

Syn.—Lichen Roccella, *Linn.* R. phycopsis, *Ach.* R. pygmæa, *Dur.*

Figures.—Sow., E. Bot., t. 211, cop. in Steph. & Ch., t. 69 (*R. phycopsis*); Nees, t. 9; Woodville, vol. v; Lindsay, Pop. Hist. Brit. Lichens, t. 5; Luerssen, Med. Pharm. Bot., p. 226.

Description.—A perennial thallophyte, 2—6 inches high, attached by a small base. Thallus much divided from the base into numerous branches which are ascending, more or less cylindrical or oval on section, solid, often somewhat nodulose, tapering gradually at the extremities, sparingly and irregularly branched, pale dull whitish-grey or yellow, often slightly farinaceous on the surface. Fructification consisting of apothecia, forming small, slightly prominent worts on the thallus at intervals, circular or irregular, slightly convex, with a faintly raised margin, nearly black. Each apothecium is composed of a somewhat convex disk or receptacle on which stand very numerous and densely crowded and agglutinated, erect, elongated, delicate, linear bodies (*paraphyses*) thickened at their extremities which together form the surface of the apothecium; mixed with the paraphyses, but fewer in number and shorter, are numerous flask-shaped sacs (*asci*) tapering below and rounded above, with a very delicate transparent wall, and containing when mature eight ovoid-oblong, nearly

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* *Roccella,* the old Italian name, first (?) met with in Ferrante Imperato's 'Hist. Nat.' (1599), and there said to be from the red colour yielded by the plant, but it seems more likely to be derived from *rocca,* a rock, in allusion to the place of growth. Another derivation is given, from the name of an old Florentine family of merchants.

straight or slightly curved, microscopic *spores* (*ascospores*) which usually have three septa across so as to be quadrilocular.

Habitat.—This Lichen grows on sea-shore rocks, an unusual locality for plants of the Order, within reach of the spray; hence in the old botanical writings it is described as a "fucus." It is a plant of very extensive geographical distribution, occurring in nearly all the warm parts of the globe. It is found on the coasts of India, of Madagascar and Mauritius, of the Cape of Good Hope, of Senegal, of the Canary Islands, and of Western Europe and the Mediterranean, and it is abundant on both the Atlantic and Pacific shores of Central and South America. As a matter of course it is variable, and many botanists consider the European plant to be a distinct species, *R. phycopsis*, Ach., distinguished by its smaller size, more branched habit, less cylindrical and non-farinaceous branches and other slight points. It is this form which reaches the Channel Isles and the south-western shores of England, the Scilly Isles, Cornwall, Devon, and Dorset. The specimens from Scilly, however, like many of those from the Mediterranean, seem quite intermediate between typical *R. tinctoria* and *R. phycopsis*, and we have followed Mudd and others in combining the two. Leighton gives both species as natives of England in his most recent volume, quoted below. *R. pygmæa*, Dur., is a minute form found in Algeria.

R. fuciformis, Ach., differs completely in its large size, flat, often ribbon-like branches, and paler colour. Its range also includes the extreme south-western shores of England, and is as wide as, or wider than that of *R. tinctoria*.

Ferrante Imperato, Historia Naturale (1599), p. 735, with figures; Hooker, British Flora, v, p. 222; Crombie, Lich. Brit., p. 23; Leighton, Lichen Flora of Britain, ed. 3 (1879), p. 73; Lauder Lindsay, Pop. Hist. Brit. Lich., p. 133; Nylander, Syn. Meth. Lich., i, p. 258.

Official Part and Names.—Litmus; a blue pigment prepared from various species of Roccella, *DC.* (B. P. *Appendix*). The entire lichen, from an infusion of which (*Lacmus, Litmus*) is prepared by the action of soda or potash (I. P). Litmus is official

solely as a chemical test in the above Pharmacopœias. It is not recognised in the Pharmacopœia of the United States. Litmus or Lacmus is also known under the names of *Tournesol in cakes* (*Tournesol en pains*) ; and *Dutch turnsole.*

Source and Preparation.—A considerable number of lichens have been employed by man on account of the colouring matters which they yield him. Thus species of *Roccella, Lecanora, Gyrophora, Variolaria, Parmelia,* &c., contain organic acids, such as *orsellic, erythric, lecanoric,* and *gyrophoric,* which are colourless while in the plant, but under the united influence of water, atmospheric oxygen, and alkalies, yield coloured products. *Purple* and *blue* colours are, in this way, obtained from several lichens. In this country, purple colours, as *orchil* and *cudbear,* are alone obtained from them ; but in Holland, the blue colour *litmus* is also prepared from the same lichens. It would appear that, any of the lichens which serve for the production of orchil may be used in the manufacture of litmus ; but the best quality is prepared in Holland exclusively from *Roccella tinctoria,* while inferior sorts are made from species of *Variolaria, Lecanora,* and *Parmelia.*

Litmus is prepared chiefly, if not exclusively, in Holland ; but it is difficult to obtain accurate information about its manufacture, which is kept very secret. It appears, however, that there are as many as nineteen sorts of litmus of varying quality kept by the Dutch manufacturers ; some of these are more than six times the value of others, notwithstanding that, according to the observations of Hanbury, there is by no means a corresponding difference in richness or intensity of colour.

The process essentially consists in macerating the coarsely ground lichens, in wooden vessels, under shelter, for several weeks, with occasional agitation, in a mixture of urine, lime, and potash or soda, by which fermentation ensues, and the mass first becomes red and then blue, when it is removed and introduced into small moulds, where it dries in the form of rectangular cakes. To give it consistence it is usual to mix with the blue pigment, before it is dried in the moulds, some calcareous or siliceous matter ; and in

the inferior sorts indigo is mixed with it to deepen the colour; or sometimes litmus powder of superior quality is added for the same purpose.

General Characters.—Litmus occurs in the form of rectangular cakes, from a quarter of an inch to an inch in length, which are light, friable, finely granular, and of an indigo-blue or deep violet colour. The odour, which resembles that of violets, is acquired while the mixture from which it is prepared is undergoing fermentation. Litmus tinges the saliva of a deep blue colour, and has a somewhat saline and pungent taste. It differs from most vegetable blues in not being rendered green by alkalies. It is reddened by acids, and restored to its original blue colour by alkalies. In the commoner sorts of litmus indigo may be frequently detected by various means, that is, by its odour; by the coppery lustre which the cakes acquire when rubbed with the nail; by digesting the cakes in oil of vitriol, by which a blue solution of sulphate of indigo is obtained; and by heating them in a watch glass, by which indigo vapour, known by its odour and reddish-violet colour, and crystals of indigo are obtained.

Uses.—Litmus is used as a test for acids and alkalies, for which purpose it is made official in the British Pharmacopœia, and the Pharmacopœia of India. Thus blue litmus paper, which is prepared by steeping unsized white paper in tincture of litmus, and subsequently drying by exposure to the air, is employed to detect the presence of acids and acidulous salts, which communicate to it a more or less red tinge; and red litmus paper, which is unsized white paper steeped in tincture of litmus which has been previously reddened by the addition of a very minute quantity of sulphuric acid, and dried by exposure to the air, is used as a test for alkalies, and salts which react as bases, which restore to the paper the blue colour of litmus.

A decoction of Orchella weed is said to possess mucilaginous, emollient, and demulcent properties, and to be useful in coughs and catarrhs and in other cases where such properties are required.

Orchil or Archil, and Cudbear.—As already noticed, these colouring matters are also prepared from the same lichens as

those from which litmus is manufactured. *Orchil* differs in appearance according to its mode of preparation, thus in commerce, we distinguish two kinds under the names of *blue orchil* and *red orchil*. Both are thickish liquids, of a deep purplish-red colour, and ammoniacal odour; but they differ in the degree of their tint, which is redder, as the name implies, in red orchil. According to Pereira, they are prepared as follows:—*Blue orchil* by steeping the lichens in a covered wooden vessel, in an ammoniacal liquor, which either consists of stale urine and lime, or is prepared by distilling an impure salt of ammonia with lime and water; and *red orchil* is made with the same liquor in common earthern jars, placed in a room heated by steam, and called a *stove*.

Cudbear is in the form of a purplish-red powder, but differing like orchil in the degree of its tint, hence two kinds are also distinguished under the names of *red cudbear* and *blue cudbear*, the former being redder than the latter. Cudbear is prepared in the same manner as orchil, by the mutual action of the lichens, air, and an ammoniacal liquor; but when the proper colour is developed, the mixture is, in this case, dried in the air, and reduced to powder.

The essential difference in the preparation of orchil and cudbear from litmus is, that potash or soda is added in the production of the latter, to the ammoniacal liquor.

Orchil and Cudbear are used for staining and dyeing purple and red colours; and also occasionally, as tests for acids and alkalies.

Per. Mat. Med., vol. ii, pt. 1, pp. 26, 32 and 37; Per. Mat. Med., by B. & R., p. 399; U. S. Disp., by W. & B., p. 1633 Watts, Dict. Chem., vol. iii, p. 730.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum and Museum of the Pharmaceutical Society.

1. A plant from Lima.
2. A specimen from the Cape of Good Hope.
3. Portion of a plant from Madeira.
4. Vertical section of an apothecium.
5. Portion of the same more highly magnified.
6. Spores.

(4, enlarged; 5 & 6, greatly magnified.)

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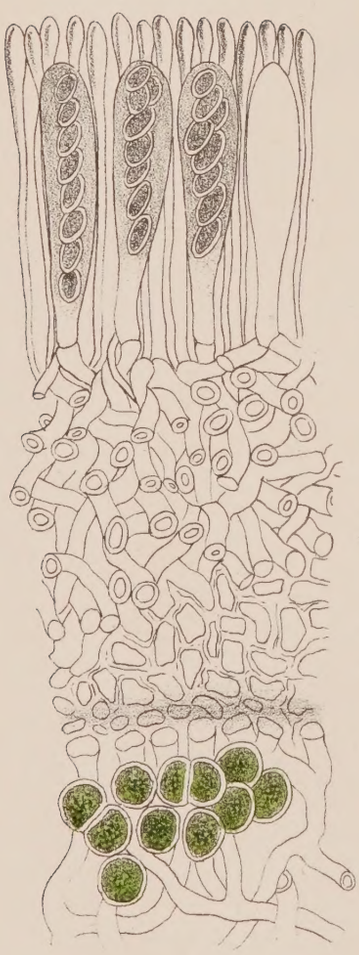

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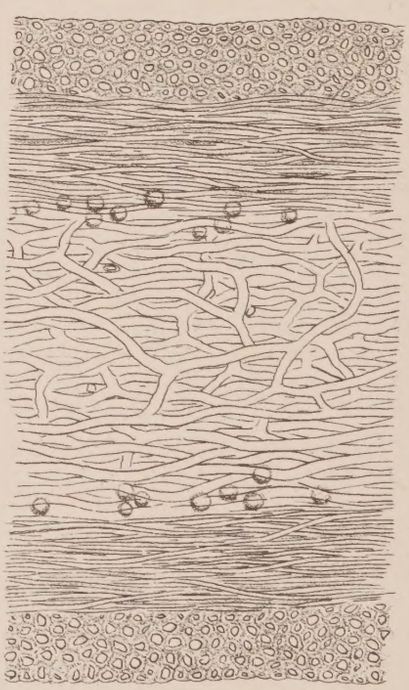

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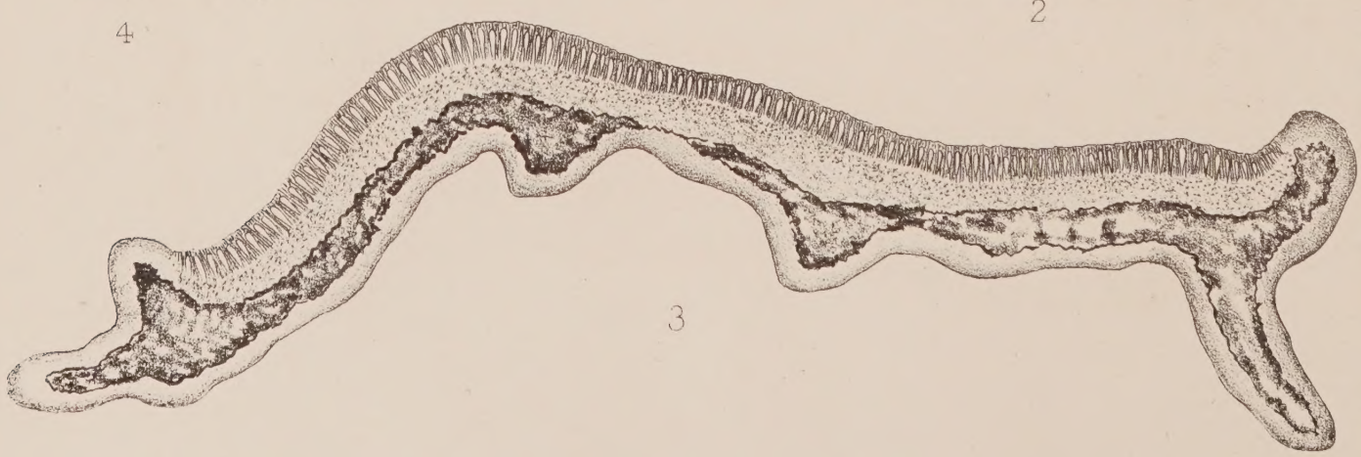

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D Blair F.L.S. ad sicc del. et lith.

CETRARIA ISLANDICA, *Ach.*

M & N. Hanhart imp

N. Ord. LICHENES.

Tribe *Cetrariei.*

Genus Cetraria,* *Ach.* Nyland., Syn. Meth. Lich., i, p. 298. There are 4 species, natives of the high northern regions of both worlds.

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302. Cetraria islandica, *Ach., Meth. Lich., p.* 293 (1803).

Iceland Moss.

Syn.—Lichen islandicus, *Linn.*

Figures.—Woodville, t. 271; Nees, t. 10; Steph. & Ch., t. 69; Berg and Sch., t. 32 d; Sow., Eng. Bot., t. 1330; Luerssen, Med. Pharm. Bot., pp. 177, 221—4.

Description.—A thallophyte of indefinite duration. Thallus about 2—4 inches high, erect, flattened and foliaceous, much divided in a dichotomous manner, the lobes variable in width, obtuse and spreading, the margin set with numerous hard, small, spinous prominences giving a ciliated appearance, the surface smooth, more or less crumpled and bullate, greenish brown or reddish, paler on one side, the back, which is marked with small white depressed spots, often blood-red at the base; apothecia rarely produced, situated at the ends of the thallus on the upper surface of broader, short lobes, large, flat, more or less circular, chestnut brown. Spores 8 in each ascus, small, unicellular. At the summit of the stiff spinous ciliations are often produced *spermogonia* which discharge minute cylindrical bodies termed *spermatia.*

Habitat.—In spite of its familiar name, this is no more a moss than *Roccella* is a seaweed; both are Lichens. The present species is a very common plant in northern countries and in the mountainous parts of those with a warmer climate. In Great Britain it is found in barren stony ground on the higher Scotch mountains, and is especially abundant in the Grampians; it also grows on Snowdon and other Welsh hills, in Yorkshire and even

* *Cetraria,* from *cetra,* a small shield or buckler, referring to the form of the apothecia.

in Norfolk, and in the South West of Ireland. The fructification, however, is but rarely produced in most of its localities. Throughout Scandinavia and Northern Europe it is a very abundant plant and in the arctic regions comes down to the sea level. Its range extends round the Pole, and in the American Continent it reaches along the mountains as far south as North Carolina, whilst in the Old World it occurs on most of the great mountain chains including the Himalayas. This lichen is also met with in the antarctic regions at Cape Horn.

Considering its great range it cannot be said to be a very variable plant; the thallus, however, varies in size, amount of division and crisping, as well as in colour. It is sometimes very much crisped and curled.

Very little is yet known of the sexual organs of Lichens, or of their mode of fertilization. The structure of the fructification (as above described) is, however, precisely like that of many Fungi of the tribe *Ascomycetes*, and in that group the asci with their contained spores are known in some cases (and presumed in the rest) to arise from a body resulting from the union of male and female organs (*pollinodia* and *carpogonia*). In Lichens, however, these have not been observed; but in one tribe, the *Collemacei*, the spermatia have been determined to be male or fertilizing bodies. Apparently identical bodies, on the other hand, in certain Fungi have been found to germinate and reproduce the species.

The nature of Lichens has of late years acquired special interest and been greatly studied in connection with the theory first promulgated by Schwendener, that they are compound beings, made up of two elements, an unicellular alga (the gonidia) and an ascomycetous fungus (the hyphæ and fructification), and that the latter is parasitic on the former. This dual nature has been strongly corroborated by the observations of several good experimental botanists, but some physiological considerations render it difficult to accept the notion of a parasitism in the ordinary acceptation of the term.

Hook., Brit. Flora, v, p. 221; Leighton, Lich. Fl. Gt. Brit., p. 96; Lindsay, Pop. Hist. Brit. Lichens, p. 153; Nylander,

Syn. Meth. Lich., p. 298; Hook. f., Fl. Antarctica, ii, p. 523; Lindl., Fl. Med., p. 627; Flück. & Hanb., Pharmacogr., p. 670.

Official Part and Names.—CETRARIA; the entire Lichen (B. P.). The entire Lichen (I. P.). CETRARIA; (U. S. P.). It is commonly known as Iceland Moss.

Collection and Commerce.—Its common name of Iceland Moss would seem to imply that our supplies of this drug are derived from Iceland, but such is not the case, for although it is collected in that island in seasons of scarcity, none is exported from thence. For local use it is collected in Sweden, Switzerland, in the mountainous districts of Spain, and in other countries; but we have no evidence of its being exported from any country except Sweden, from whence our supplies appear to be entirely derived.

General Characters and Composition.—In a dried state, as seen in commerce, Iceland moss has generally a brownish or greyish-white colour; the upper surface darker than the under, which is marked at irregular intervals with depressed white spots. The apothecia may rarely be found towards the margin of the thallus, as flat, shield-like bodies, of a dark rusty or chestnut-brown colour, with raised borders. The thallus is smooth, foliaceous, with irregular fringed lobes, crisp, light, somewhat coriaceous, almost odourless when dry, but when moistened having a feeble seaweed-like smell; its taste is mucilaginous and slightly bitter. A strong decoction gelatinises on cooling.

Iceland moss contains about 70 per cent. of *lichenin* or *lichen starch*, a substance agreeing in composition with that of starch and cellulose. It becomes blue on the addition of iodine. Lichenin contains no inorganic constituents, and yields but slight traces of mucic acid when boiled with concentrated nitric acid, in which particulars it differs from gums and mucilages. The bitter principle, which exists in Iceland moss in the proportion of about 3 per cent., is termed *cetraric acid* or *cetrarin*. This crystallises in minute needles, which are colourless, very bitter, nearly insoluble in water, but soluble in alcohol and slightly so in ether, and forming with alkalies, bitter, soluble, yellow salts.

The lichen also contains about 1 per cent. of a peculiar body called *licheno-stearic acid,* a little *sugar, fumaric acid,* and *oxalic acid* in small proportion. When treated with sulphuric acid, Iceland moss yields 72 per cent. of glucose, which may be converted into alcohol.

Medical Properties and Uses.—Iceland moss possesses demulcent and tonic properties; and when deprived of its bitter principle, it is nutritive, and may therefore be used as an article of diet. Cetraric acid and its salts have been recommended for use in intermittents as a substitute for quinine. Iceland moss has been found serviceable in chronic affections of the pulmonary and digestive organs, as chronic catarrh, dyspepsia, chronic diarrhœa and dysentery, and in advanced phthisis where stronger remedies are unsuitable. Its efficacy as a medicine has been, however, much exaggerated.

It is best administered as a remedial agent in the form of the official decoction. But when employed merely as an alimentary substance, the bitter matter should be extracted, either by heating the lichen once or twice in water up to about 180° Fahr., by which most of its bitterness will be removed; or by macerating it in a weak alkaline solution made with one part of an alkaline carbonate in 375 parts of water, by which the bitterness is entirely removed. The lichen may be then boiled in water or milk; and when sufficiently concentrated it gelatinises on cooling. It may be flavoured with sugar, lemon peel, white wine, or aromatics, and then forms an agreeable kind of diet.

It was formerly used in this country and elsewhere in a ground state mixed with chocolate or cocoa, and taken as a beverage at the morning and evening meal.

In times of scarcity it is sometimes employed in Iceland and elsewhere, as an article of diet, for which purpose it is ground and mixed with the flour used in making grain soup, or it is boiled with milk.

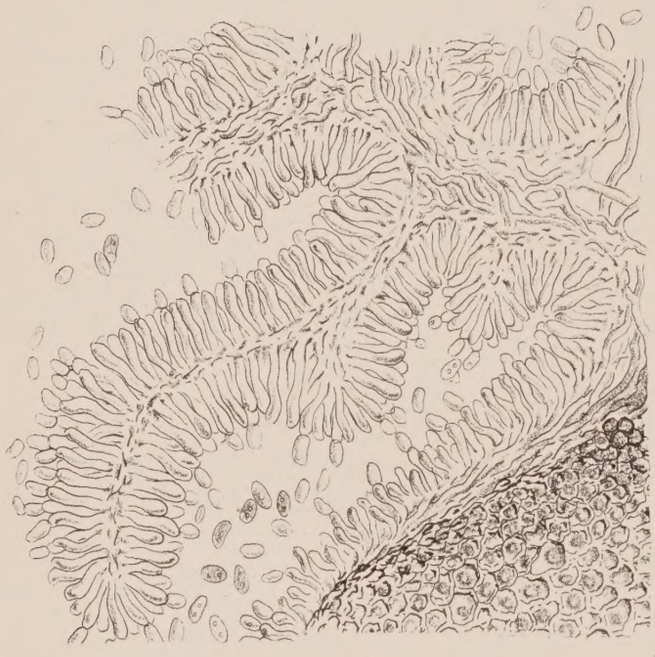
Per. Mat. Med., vol. ii, pt. 1, p. 22; Per. Mat. Med., by B. & R., p. 396; Pharmacographia, p. 670; U. S. Disp., by W. & B., p. 253; Journ. de Pharm., vol. xxiii, p. 505; Ann. der Pharm., vol. lv, p. 144; Dingler, Polytechnisches Journal, 197 (1870), p. 177.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, gathered in Switzerland, the details added from Berg and Schmidt, and Luerssen.

1. Whole plant in fruit.
2. Section of the thallus.
3. Section through an apothecium.
4. The same more highly magnified, showing also the green gonidia in the subcortical layer of hyphæ.
5. A spermogonium discharging spermatia.

(2–5, greatly magnified.)



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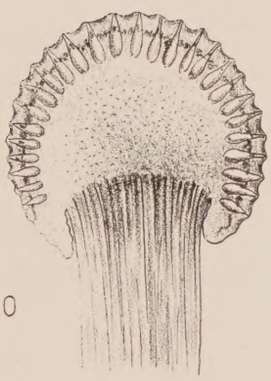

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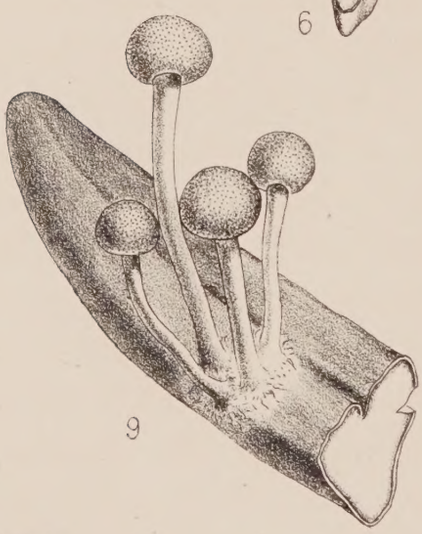

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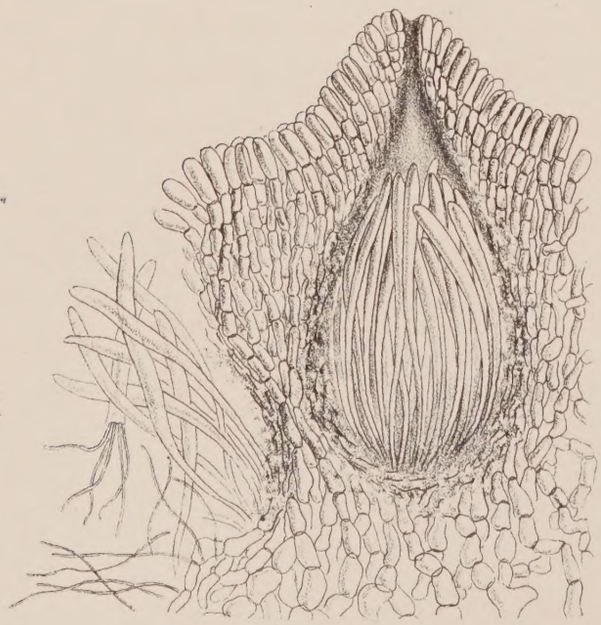

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D.Blair F.L.S. ad sicc. del. et lith.

CLAVICEPS PURPUREA, *Tul.*

M & N.Hanhart imp.

N. Ord. Fungi. Lindl., Veg. Kingd., p. 29; Le Maout & Dec., p. 949.

Tribe *Ascomycetes.* (*Pyrenomycetes.*)

Genus **Claviceps,*** *Tulasne.* Three species are recognised, all parasitic on the flowers of glumiferous plants.

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303. Claviceps purpurea, *Tulasne in Ann. d. Sc. Nat., ser.* 3, xx, *p.* 45 (1853).

Ergot. Ergot of Rye.

Syn.—Sclerotium Clavus, *DC.* Spermoedia Clavus, *Fries.* Sphacelia segetum, *Lév.* Ergotætia abortifaciens, *Quek.* Oideum abortifaciens, *Berk. & Br.* Cordiceps purpurea, *Fr.*

Figures.—Steph. & Ch., t. 113; Nees, Supp.; Berg & Sch., t. 32 c; Tulasne, in Ann. Sc. Nat., ser. 3, xx, tt. 1—3; Luerssen, Med.-Pharm. Bot., pp. 157—163.

Description.—A biennial thallophyte, parasitic on the ovary of various grasses. It commences as a sticky, filamentous substance (*mycelium*) between the pales at the base of the ovary, and gradually spreads over its surface, penetrates into its substance, and destroys its tissues. The fungus is at this stage called *sphacelia;* it is soft and mucilaginous in texture, the surface being yellowish in colour, and much furrowed and wrinkled with deep tortuous ridges. The fructification consists of a very large number of minute spores (*spermatia, conidia*), separating from the ends of elongated cells (*basidia*) which cover the tortuous ridges, and are immersed in the mucilage. At the base of the sphacelia the mycelium is thick and firm; it increases in quantity and density, and gradually pushes the sphacelia upwards, ultimately forming what is known as the *sclerotium, stroma,* or *ergot.* This is an oblong-fusiform body, ½—1½ inch long, somewhat curved, blunt at the top (which is at first crowned by the dry and shrivelled sphacelia, which soon falls away), nearly cylindrical, but with one or two furrows, and more or less cracked on the surface,

* *Claviceps;* from *clavus,* a nail or knob, in allusion to the form of the perfect fungus.

violet-purple in colour, white internally, hard and dense, the tissue of the ovary having been wholly replaced by closely-packed polygonal cells. When fully mature the ergot projects much beyond the pales, which are forced apart by it. The fructification is quite different from that of the sphacelia state, and exhibits a more perfect condition of the plant. From the surface of the sclerotium groups of several little mushroom-like fungi are pushed out, each consisting of a nearly spherical top (*receptacle*), about the size of a large pin's head, supported on a slender stalk $\frac{1}{8}$—$\frac{1}{2}$ inch or more long. The surface of the receptacle is rough with little prominences, each corresponding with the orifice of a small flask-shaped cavity (*perithecium*); from the base of each perithecium arise numerous elongated sacs (*asci*), each of which contains several slender, thread-like spores (*ascospores*).

Habitat.—The ergot or sclerotioid condition of this remarkable fungus has long been known, and was formerly thought to be a peculiar condition or hypertrophy of the grain; thus, Rye affected by its presence was called "Secale cornutum" and "Secale luxurians," and "Eared or Spurred Rye." The parasite is, however, quite a distinct organism from the plant it attacks. Unlike most destructive fungi, it confines its ravages entirely to the single flower which it infests, and does not injure the general development of the plant. It is by no means confined to Rye, being found frequently on wheat and barley, and on a large number of wild grasses; it is especially frequent on *Glyceria fluitans*, a common water-grass in this country. The ergot of this is much smaller and narrower than that of Rye, and generally the size and form of the sclerotium varies according to the species on which it occurs. Ergot is frequent on *Lolium temulentum*, and this is, perhaps, the cause of the poisonous properties ascribed to that grass (see No. 295).

The structure of the Ergot was well investigated at the beginning of this century, as is evidenced by the beautiful series of drawings by Francis Bauer, preserved in the British Museum. He figures the sphacelia, which, however, was not so called till 1827, when Leveillé described it as an independent fungus. The

spermatia were first observed by Quekett in 1841, and are the spores of his *Ergotætia abortifaciens*. The perfect ascophorous fungus had been observed by several botanists before 1853, but was not understood to form a part of the life-cycle of the Ergot plant till Tulasne, in his fine memoir published that year, traced out the whole history of *Claviceps purpurea*.

The fungus is propagated both by the spermatia and the ascospores, either of which will germinate on the ovary and reproduce the parasite. The ergots are fully matured and hard about July, and after falling from the plant, remain in a dormant state on the ground during the winter; in spring or early summer they produce the perfect *Claviceps*, the spores of which are ripe at the time when the grasses are coming into flower.

Cooke, Handbook Brit. Fungi, ii, p. 772; Tulasne, in Ann. Sc. Nat., ser. 3, xx, p. 1; Lindl., Fl. Med., p. 623; Flück. & Hanb., Pharmacogr., p. 672.

Official Part and Names.—ERGOTA; the sclerotium (compact mycelium or spawn) of Claviceps purpurea, *Tulasne*, produced within the paleæ of the common rye, Secale cereale, *Linn.* (B. P.). The sclerotium (compact mycelium or spawn) of Claviceps purpurea, produced within the paleæ of the common rye (I. P.). ERGOTA; the sclerotium of Claviceps purpurea, *Tulasne*, replacing the grain of Secale cereale (U. S. P.). It is commonly known as Ergot, Ergot of Rye, Spurred Rye, or Horned Rye.

Commerce.—As a general rule, the production of ergot diminishes as agriculture improves; but humidity of climate is also favorable to its formation. Ergot is largely produced in Spain, chiefly in Galicia, and in Southern and Central Russia; and to some extent in Germany, France, and other countries. Our supplies are principally derived from Vigo, in Spain, and from Teneriffe; but also, in some degree, from France and Hamburg.

General Characters.—Spurred Rye or Ergot, consists of grains, which vary in length from about one third of an inch to an inch and a half; and in diameter from half a line to four lines. In form these grains are subcylindrical or obscurely triangular,

tapering towards each end, with obtuse extremities, generally arched or curved somewhat like the spur of a cock, hence the name of spurred rye, longitudinally furrowed on each side, but more especially on that which is concave, and often irregularly cracked. The grains are violet-brown or blackish externally, and more or less covered by a bloom; and pinkish-white or whitish internally. They are firm, somewhat horny, elastic, moderately brittle, and break with a close fracture when dry. When in quantity they have a peculiar nauseous, fishy odour, which becomes very strong if the ergot is powdered and the powder triturated with solution of potash. They have little taste at first; but subsequently they are mawkish, rancid, and very slightly acrid.

Preservation.—Ergot is liable to become deteriorated by keeping, more especially when in a state of powder, partly from the attacks of a species of mite of the genus *Trombidium,* and partly from oxidation of its contained fixed oil. Various methods have been tried for its preservation; thus, Dragendorff thinks that if deprived of its fat immediately after powdering, and again drying, the resulting powder will retain its activity for a long time. Camphor has also been employed for preserving it; and recently, Mourrut has recommended that freshly-powdered ergot should be mixed with 5 per cent. of powdered benzoin, by which, he says, its physical and medicinal properties are preserved without alteration. Groves has suggested that if ergot be pressed into a firm, coherent cake, so as to remove the oil, it would withstand the attacks of insects and the effects of the atmosphere much better than when in its ordinary condition. H. Ducros recommends that ergot be kept in glass-stoppered bottles covered with a copious layer of powdered wood charcoal. In this way, he states, he has preserved ergot for years. Our experience is, that if ergot be well dried at first, and afterwards kept in a warm and dry place, either exposed to the air or in hermetically sealed bottles, it will keep for years.

Composition.—Ergot has been repeatedly analysed, but as the results of recent investigations are somewhat conflicting, further experiments are desirable, and more especially upon the therapeu-

tical action of the different principles which have been indicated as constituents. Until the last few years the principal constituents of ergot, as determined more especially by Wiggers and Wenzell, have been regarded, as about 30 per cent. of a non-drying, fatty, yellow, saponifiable *oil*, a small quantity of *cholesterin*, about one tenth per cent. of the sugar found in several other fungi, named *mycose*, nearly 7 per cent. of *resin*, and two peculiar alkaloids termed *ecboline* and *ergotine*, combined with a volatile acid named *ergotic acid*. The resin has been said to have feeble irritant properties; ergotine to be but slightly active; while in ecboline the special activity of the drug has been supposed to reside. Of late years, however, the chemistry of ergot has been considerably advanced by the elaborate investigations of Dragendorff and Padwissotzky, and those of Buchheim, and Tanret. The active constituent is regarded by Buchheim as derived from the gluten of the rye; he calls it *ergotin*, and describes it as a substance which most closely resembles animal gelatine. It appears to be nearly related to the ergotin described by Wiggers in 1830.

According to Dragendorff and Padwissotzky, the two principal active constituents of ergot of rye are a slimy substance, which they have termed *scleromucin*, and an acid named *sclerotic acid*, both of which are soluble in water and contain nitrogen; and both are colloidal, but give no reactions by which albuminoidal, alkaloidal, or glucosidal properties could be inferred. Sclerotic acid is recommended most strongly for therapeutical use. The authors also describe several other constituents of ergot, as, for instance, a red colouring matter named *sclererythrin*, another colouring matter named *scleroiodin*, both of which are regarded as possessing some activity; and other substances which appear to be inactive. The authors also believe that Wenzel's *ergotine* and *ecboline* are identical and inactive.

The investigations of Tanret lead to the conclusion that the essential active constituent of ergot is an alkaloid which has been named *ergotinin* or *ergotinia*. He has obtained this alkaloid both in a crystalline and amorphous state, and he attributes the rapid alteration of powdered ergot to the instability of this principle.

Dragendorff and Padwissotzky do not consider this ergotinin as a chemically distinct substance, but an admixture of their sclererythrin and other substances. The more recent experiments, however, of Tanret, seem to confirm its alkaloidal nature.

Medical Properties and Uses.—In medicinal doses ergot acts principally upon the muscular fibres of the uterus, causing them to contract strongly and continuously, more especially during labour and after delivery, hence it is largely used to promote contraction of the uterus in cases of tedious parturition, or to prevent flooding after delivery. The administration of ergot is also most beneficial in menorrhagia and leucorrhœa. Moreover, as ergot causes contraction of the small arteries generally by its action on their muscular walls, it is a powerful agent in checking hæmorrhage, whether from the lungs or bowels; and also to diminish congestion in affections of the cerebro-spinal membranes, and in other cases. It has likewise been employed to cause the expulsion of coagula of blood, polypi, and hydatids, from the uterus.

In over doses ergot produces nausea, vomiting, colicky pains, headache, and sometimes delirium, stupor, and even death. Taken for a length of time, as in bread made with diseased rye, it acts as a poison, producing two conditions of the constitution, termed respectively gangrenous ergotism and convulsive ergotism, both accompanied with formication.

Per. Mat. Med., vol. ii, pt. 1, p. 102; Per. Mat. Med., by B. & R., p. 386; Pharmacographia, p. 673; U. S. Disp., by W. & B., p. 377; Royle, Mat. Med., by J. Harley, p. 366; Mourrut, Rep. de Pharm., May 10th, 1877; Ducros, Zeitsch. Oest. Ap. Ver., No. 1, 1876, p. 8; Dragendorff, in New Remedies, Feb., 1877, p. 46, from Jahresb. f. Pharm.; Pharm. Jl., ser. 3, vol. ix, p. 665; Buchheim, Proc. Amer. Pharm. Assoc., vol. xxiv (1876), p. 117, from Archiv. Pharm., July, 1875, p. 32; Dragendorff, in Pharm. Jl., vol. vi, ser. 3, p. 1001, and Proc. Amer. Pharm. Assoc., vol. xxiv (1876), p. 119; Tanret, in Compt. Rend., Nov. 15, 1875, Journ. de Pharm. et de Chim., Sept., 1876, and Pharm. Jl., vol. vii, ser. iii, p. 249; Tanret, Rep. de Pharm., 1878, and in Proc. Amer. Pharm. Assoc., vol. xxvi (1878), p. 604; Blumberg, in Pharm. Jl., ser. iii, vol. ix, pp. 23, 66, 147, and 598.

DESCRIPTION OF PLATE.

Drawn from European specimens in the British Museum; the details added after Francis Bauer and Tulasne.

1. An ear of rye affected with ergot.
2. A young ergot capped with the sphacelia.
3. The same more advanced.

4 and 5. A fully developed ergot.

6. Transverse section of the same.
7. Section through the junction of the sphacelia and the sclerotium showing the spermatia.

8, 9. An ergot with fructification.

10. Vertical section of the receptacle.
11. A perithecium.
12. Asci and spores.

(2, 3, 8, 9 enlarged; 7, 10–12 much magnified.)

D.Blair F.L.S. ad nat. del. et lith.

FUCUS VESICULOSUS, *Linn.*

M&N.Hanhart imp.

N. Ord. ALGÆ. Lindl., Veg. Kingd., p. 8; Le Maout & Dec., p. 965.

Tribe *Fucaceæ*.

Genus Fucus*, *Linn.* (in part). Agardh, Sp. Alg., i, p. 207.
Species 6, natives of the seas of the northern hemisphere.

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304. Fucus vesiculosus, *Linn., Sp. Plant., ed.* 1, *p.* 1158 (1753).

Bladder Wrack. Cut-weed.

Syn.—F. spiralis, *Linn.* F. divaricatus, *Linn.* F. distichus, *Lightf.* F. balticus, *Ag.* F. platycarpus, *Thuret.*

Figures.—Steph. & Ch., t. 108; Woodville, vol. v; Sow., E. Bot., tt. 1066, 1685; Turner, Fuci, t. 88; Greville, Scott. Crypt. Flora, t. 319; Harvey, Phycol. Brit., t. 271 (10); Thuret, in Ann. Sc. Nat., ser. 4, ii, tt. 12—14, and Études Phycolog., tt. 15—17.

Description.—A thallophyte of perennial duration, erect, varying in height from 2 inches to over 3 feet, provided at the base with a dilated, hard disk of attachment. Frond rather fan-shaped, narrow and strap-shaped at the base, the rest flat and foliaceous, wavy, many times dichotomous with erect divisions, with a very strong, broad, compressed midrib running to the apex; margin quite entire, texture tough and leathery, olive-brown the younger portions yellower, shining; air-vesicles, when present, developed in the substance of the frond, usually in pairs, are on either side of the midrib, and often one at the fork of the divisions, broadly oval or spherical, attaining, when fully grown, half an inch in diameter. Fructification contained in small globose, dicœcious or moncœcious *conceptacles* with a firm wall lined with very numerous jointed hairs, and sunk in the surface of large ovoid, oblong or narrower, pointed or blunt, swollen *receptacles*, filled with a transparent, mucous network; these attain an inch in length, and are situated at the ends of the divisions of the frond. Male organs (*antheridia*):—Very numerous, minute, oblong-ovoid cysts on the branched hairs lining the conceptacles, and containing microscopic *antherozoids*, provided with a delicate cilia at either end, which are liberated by the rupture of the antheridium. Female organs

* *Fucus*, φύκος, the classical name for many seaweeds and other marine organisms.

(*sporangia*) :—Few, globular or broadly ovoid cysts, much larger than the antheridia, and when mature containing a single mass (*octospore*), which escapes by the rupture of the sporangium, and, after it becomes free, resolves itself into 8 separate spores, which disengage themselves from their common envelopes and are liberated.

Habitat.—Every one must be familiar with this common seaweed, which abounds around our coasts on stones and rocks which are left uncovered at low water, and extends up the estuaries of rivers, growing everywhere on the sides of piers and quays. It is equally common on all the shores of the North Atlantic Ocean, from Norway and Greenland to the Azores and West Indies, and a small form extends up the Baltic; but it does not occur in the Mediterranean, except in the Adriatic. It is also found on the Pacific coast of North America from Kamptschatka to California. It is doubtful if it be met with in the Southern Hemisphere.

There are many varieties, but they chiefly differ in size; a very dwarf state grows in the mud of river mouths. The most remarkable is *F. platycarpus*, Thuret, in which the antheridia and sporangia are found together in the same conceptacles. This is a very common form; the receptacles are broader and blunter than in the type, and it is usually without air-vesicles. In *F. spiralis* the frond is often spirally twisted.

The fruit is found in perfection at the end of autumn and in winter. The fertilisation of the free spores is effected in the water by the liberated spermatozoids, which are endowed with active movement, and swarm round the spore, attaching themselves to its outer surface. After fertilisation the spores germinate, and at once give rise to a young plant like their parent.

Agardh, Sp. Alg., i, p. 210; Thuret., in Ann. Sc. Nat., ser. 4, ii, p. 197, and Études Phycolog., p. 39; Lindl., Fl. Med., p. 630.

Part Used and Names.—FUCUS VESICULOSUS; the entire alga. It is not official in the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States. The "herb and fruit" were, however, formerly recognised in the Dublin

Pharmacopœia, but the drug was omitted from that volume in 1850. It was also official in other Pharmacopœias. It is commonly known as Bladder Wrack, Bladder Fucus, Sea Wrack, Sea Lettuce, Black Tang, and other names.

History.—This fucus was first brought prominently into notice as a remedial agent by Dr. Russell in 1750. He recommended it for use in the forms of a kind of charcoal, which was subsequently termed *Vegetable Ethiops*, and of a *jelly*. The former was prepared by incinerating the fucus in a crucible covered with a perforated cover until smoke ceased to be given off; and the latter, either by expressing its mucilaginous liquid, or by macerating the fucus in an equal weight of sea water for about a fortnight, or until it was converted into a kind of jelly. This mucilaginous liquid or jelly was employed by Dr. Russell successfully as a resolvent in scrofulous and other glandular affections, both externally and internally. Dr. Russell also administered vegetable ethiops with beneficial effects in similar diseases. The successful results obtained by its employment led afterwards to its admission into several pharmacopœias; but after the introduction of iodine into medicine, to which its effects were commonly regarded as being essentially due, and to which its use and that of burnt sponge had brought prominently into notice, it gradually fell into disuse, although it was still recognised in the Dublin Pharmacopœia until the year 1850.

It was subsequently tried about the year 1862 by Dr. Duchesne-Duparc in chronic psoriasis, but without any special effect in that affection; he noticed, however, that under its employment, an unexpected result was obtained, namely, that of diminishing obesity, without, in other respects, producing any disturbance of the general health. Dr. Godefroy subsequently confirmed these results by experiments on himself; and although the trials of other experimenters have not always led to any marked results, it is a substance which deserves more complete investigation than it has hitherto received.

General Characters.—In substance this alga is thickish, flexible, and very tough. It has, when fresh, a dark olive-brown appearance, being paler at the extremities, and becoming nearly

black by drying. It has a strong odour, and a nauseous saline taste.

Duchesne-Duparc lays especial stress upon the necessity of distinguishing this fucus from others, such as *Fucus nodosus, Fucus serratus,* &c., which, he says, are often substituted for it, but are of very inferior value. The distinguishing characters of the frond or thallus of *Fucus vesiculosus* from these are, its entire margin; its strong distinct midrib running throughout the entire length both of it and its branches; and in its vesicles or air-bladders being placed in pairs, one on each side of the midrib.

Preparation.—For use in medicine its preparation has been thus recommended by Dannecey. He directs the plant to be gathered at the period of fructification, about the end of June, and dried rapidly in the sun, when it becomes brittle, and may be readily reduced to coarse powder; but if dried by artificial heat, he says, it always retains its hygroscopic qualities, and does not become brittle. The coarsely-powdered fucus is then to be macerated for about three days with four times its weight of 86 per cent. alcohol, then expressed, and the residue subjected twice successively to a similar treatment with 54 per cent. alcohol. The tinctures are then to be mixed, the alcohol distilled off, and the remainder evaporated to the consistence of an extract. A syrup may be prepared by dissolving a little of the extract in diluted alcohol, and mixing this with syrup in the proportion desired.

Composition.—Bladder wrack has been frequently analysed, from which it appears that its principal constituents are the same as those of many allied algæ; these are *mucilage, mannite, odorous oil, bitter principle,* and a considerable proportion of *saline matter,* varying from 14 to 20 per cent. in the dried plants, and containing *iodine* and *bromine.* The proportion of saline matter is also said to vary in the same plant when obtained from different localities, and when gathered at different seasons, being most abundant at the period of fructification, about the end of June, at which period, as we have already mentioned, bladder wrack is recommended to be collected for use. Marchand found in the ashes of *Fucus vesiculosus* 0·709 per cent. of *iodine,* and 0·603 per

cent. of *bromine;* he also ascertained that many allied algæ contained much more iodine, thus the ashes of *Laminaria digitata* contain seven or eight times more. Hence, if iodine be the principal active constituent, the latter alga would be much more valuable than the former.

Medical Properties and Uses.—The uses of vegetable ethiops and the jelly prepared from *Fucus vesiculosus* in scrofulous tumours and glandular enlargements have been already referred to. Mr. Tamplin had a high opinion of fucus or sea-weed wine as a remedy in diseases of the hip and other bones and joints of children. This wine was made from the following formula:—Grapes, 98 lbs.; distilled water, 16¾ gallons; white sugar, 84 lbs; bitartrate of potash, 16¾ oz.; dried *Fucus vesiculosus,* 23 lbs. 9 oz. Crush the grapes, and pack them in a cask with alternate layers of the fucus. Dissolve the sugar and bitartrate of potash in the water, and pour the solution upon the fucus and grapes. Keep in a warm place, and, if necessary, add a little yeast to promote fermentation.

The chief interest in reference to the action of this fucus, relates, however, to its reputed value as a remedy for obesity. From experiments of Dr. Godefroy on his own person, which we have noticed previously under the head of history, it appears that, in the period from the 6th of March to the 18th of May, under the use of the extract in doses of 4½ grains taken thrice daily at the commencement of each meal, he lost about 5¼ lbs. in weight; and that beyond its effect on the urine, which was rendered more abundant, more coloured, and more odorous than usual, he observed no physiological effect. Further trials are necessary before any definite conclusions can be arrived at on its action and its value as a remedy in obesity. It would appear that it is the essential constituent in the nostrum now so extensively advertised under the name of Anti-Fat.

Besides its employment in medicine, this fucus has important economical uses; thus, from the ashes of this and many other algæ, commonly known as *kelp,* iodine is principally obtained. It also forms an excellent manure for land, for which purpose it

is largely used in some parts of Scotland, the Channel Islands, and other countries. Greville says that during the winter, in some of the Scottish islands, horses, cattle, and sheep are fed on it. Linneus also states, that in Gothland the inhabitants boil it in water, and mixing a little coarse meal or flour, feed their hogs with it, for which reason they call the plant *swine-tang*. And in Scandinavia, he says, the poor people cover their cottages with it, and sometimes also use it for fuel.

Per. Mat. Med., vol. ii, pt. 1, p. 7; Per. Mat. Med., by B. & R., p. 380; U. S. Disp., by W. & B., p. 1598; Watts' Dict. Chem., vol. v, p. 210; Steph. & Church., Med. Bot., by Burnett, vol. ii, pl. 108; Bentl., Man. Bot., 3rd edit., pp. 708 and 709; Pharm. Jl., ser. 2, vol. xiv, p. 131, and vol. viii, p. 616; Journ. de Pharm., Juillet, 1862, p. 65, and Nov., 1862, p. 434; Maisch., in Amer. Jl. of Pharmacy, Sept., 1876, p. 395, and Pharm. Jl., ser. 3, vol. vii, p. 289; Marchand, in Amer. Jl. of Pharmacy, 1854, p. 438; Proc. Amer. Pharm. Assoc., vol. xxvi (1878), p. 173, from New Remedies, Nov., 1877, p. 322; Report on the Exhibits in the Paris Exhibition, by Paul Holmes, and Passmore, in Pharm. Jl., ser. 3, vol. ix, p. 303.

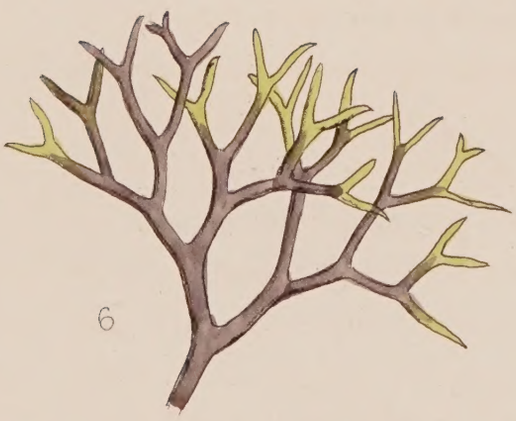
DESCRIPTION OF PLATE.

Drawn from a plant collected at Eastbourne, Sussex, by Mr. Roper; the details added after Thuret.

1. Portion of a frond with ripe receptacles.
2. Transverse section of a receptacle.
3. Antheridia on the branched hairs of the male conceptacle.
4. Vertical section of a female conceptacle.
5. Spores of the octospore fully separated, and disengaging themselves from their coverings.
6. A spore being fertilised by the antherozoids.

(2 enlarged; 3–6 much magnified.)

1



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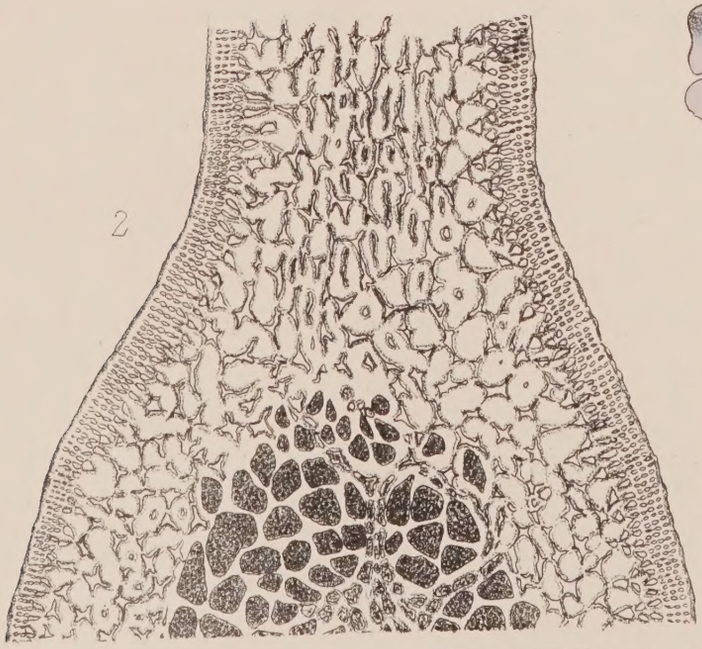

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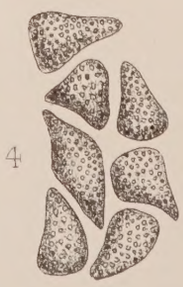

4

3

CHONDRUS CRISPUS, *Lyngb.*

E.Blair F.L.S. ad sicc. del. et lith.

M & N.Hanhart imp.

N. Ord. ALGÆ.

Tribe *Florideæ*.

Genus Chondrus,* *Stackhouse*. Ag., Sp. Alg., ii, p. 244.
Species 9, natives of the Atlantic and Pacific Oceans.

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305. Chondrus crispus, *Lyngbye, Tent. Hydrophyt. Dan., p.* 15 (1819).

Carrageen Moss. Irish Moss.

Syn.—Fucus crispus, *Linn.* F. polymorphus, *Lamour.* F. ceranioides, *Gmel.* Sphærococcus crispus, *Agardh.*

Figures.—Berg & Sch., t. 33 a; Pereira, Mat. Med., ii, pp. 10, 11; Harv., Phyc. Brit., t. 63 (197); Sow., E. Bot., t. 2285; Turner, Fuci, tt. 216, 217; Greville, Alg. Brit., t. 15; Kützing, Phyc. Gener., t. 73.

Description.—A perennial thallophyte, 3 to 10 inches in height, consisting of a flat, dilated frond supported on a slender stalk expanded at the base into a radical disk, by which the plant is attached. Frond usually very broadly fan-shaped, and repeatedly divided dichotomously into wedge-shaped, spreading segments, which vary very much in width, and are obtuse or truncate or lobed or sharply bifid at the apex, often much curled and overlapping one another, the margin entire, often giving off young fronds, texture cartilaginous without any nerves, colour various, usually greenish-purple or purplish-brown or yellowish-green, smooth and shining. Fructification of two sorts:—1, the most usual kind forming circular or oval spots on the frond (*cystocarps, favellidia*), prominent on one side, usually concave on the other, and containing in their central part a branched, filamentous network bearing the spores; 2, more rare, forming somewhat similar spots on the terminal segments (*sori*), and consisting of cruciately divided spores (*sphærospores, tetraspores*).

Habitat.—This pretty seaweed is nearly as well known as the bladder wrack, being a very common species on our shores about low-water mark, and thrown up copiously by the waves. It is remarkable for its extreme variability, scarcely two specimens

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* *Chondrus*, from the Greek χόνδρος, cartilage.

being quite alike in form and colour. The difference is mainly due to the great diversity in the width of the segments from quite linear to several inches across; the very broad forms are especially found on the muddy shores of estuaries with brackish water. No less than thirty-five varieties are figured by Lamouroux.

The range of distribution is confined to the shores of the North Atlantic, it extends from the coast of Norway to South Portugal and Gibraltar, but not to the Mediterranean, and also includes the eastern coast of North America.

Agardh, Sp. Alg., ii, p. 246; Lindl., Fl. Medica, p. 631; Flück. and Hanb., Pharmacogr., p. 679.

Official Part and Names.—CHONDRUS; (U. S. P.). The dried plant is used. It is not official in the British Pharmacopœia, or the Pharmacopœia of India. It is commonly known under the names of Irish Moss and Carrageen.

Collection, Preparation, and Commerce.—Carrageen is principally collected for use on the west and north-west coast of Ireland, Sligo being a great mart for it. It is also obtained on the southern coast of Massachusetts, in the United States; and some of good quality is also imported from Hamburg. When collected, it is washed and dried for use in medicine, and for other purposes. In Massachusetts it is said to be collected to a very large extent during four months in the year, the gatherers being Irish emigrants; the quantity obtained being estimated by Melzar, in 1860, at about five hundred thousand pounds annually. It is prepared for the market by spreading it high up on the beach to dry and bleach in the sun.

General Characters and Substitutes.—When fresh, as already noticed in our botanical description, this alga varies in colour from yellowish green to greenish-purple or purplish-brown, but as seen in commerce in a dried state, carrageen is white or yellowish, with occasionally purplish portions. The separate pieces are two to three or four inches long, crisp or somewhat horny, translucent, mucilaginous in taste, and without any marked odour. Carrageen swells in cold water to its original bulk, and then acquires a sea-

weed smell; and when boiled in from 20 to 30 times its weight of water for a few minutes, it gelatinises on cooling.

From ignorance, or the careless manner in which carrageen is usually collected, it is often mixed with other species of algæ, of which by far the most frequent is *Gigartina mamillosa*, J. Ag. (*Chondrus mamillosus*, Grev.); indeed, this alga appears, in some districts, to be collected indiscriminately with *Chondrus crispus*. It is distinguished from carrageen by its frond or thallus being slightly channelled towards the base; but more especially by its fructification being placed on the flat portions of the frond on little elevated or stalked tubercles—that of *C. crispus* being either imbedded in the frond, or scarcely elevated above it. *Gigartina acicularis*, Lamour, is another species sometimes found mixed with carrageen, but it is readily distinguished by its slender cylindrical branches. Other species of algæ may be readily known by their different botanical characters.

Composition.—Carrageen contains, amongst other constituents common to marine algæ, a notable proportion of *mucilage*. It has been frequently analysed, but with varying results, the most recent examination being by A. H. Church, who found in 100 parts, 9·38 albuminoids, 54·54 mucilage, &c., 2·15 cellulose, 14·15 ash, and 18·78 of water. His experiments also confirm the presence in it of a large percentage of sulphur compounds, the nature of which, however, he did not definitely determine; but from carefully cleaned and dried carrageen, he obtained 6·41 per cent. of such compounds.

Medical Properties and Uses.—Carrageen or Irish Moss possesses emollient, demulcent, and nutritive properties. In the forms of decoction and jelly it is a common popular remedy, in many districts, in pulmonary complaints, diarrhœa, affections of the kidneys and bladder, and in other cases. It has also been employed in combination with chocolate or cocoa.

As a dietetic article it is said to be easy of digestion, and has been used in the preparation of blanc-mange, jellies, white soup, &c. Its value, however, as a nutrient substance appears to have been over-estimated.

Administration.—When employed in medicine, or for other purposes, it is best administered in the form of decoction or jelly. The decoction may be made by macerating half an ounce of carrageen in cold or warm water for ten minutes; then boiling in three pints of water for a quarter of an hour, and straining through linen. Milk may be substituted for water when the decoction is required to be very nutritious. Sugar, lemon-juice, or some aromatic may be added to improve the flavour. Carrageen jelly may be prepared either by adding sugar to the above-strained decoction, and boiling down until the liquid is sufficiently concentrated to gelatinise on cooling; or by employing a larger quantity of carrageen. If milk be substituted for water, carrageen blanc-mange is obtained. Flavouring ingredients may be added to the jelly as in the ordinary decoction.

Bandoline or fixature, used for stiffening the hair and keeping it in form, is also commonly prepared from carrageen. In some parts of the United States the mucilage of carrageen is likewise much employed as a size for paper, cotton goods, felt and straw hats; and for thickening the colours used in calico printing. Carrageen is also employed for fining beer, coffee, &c., in America.

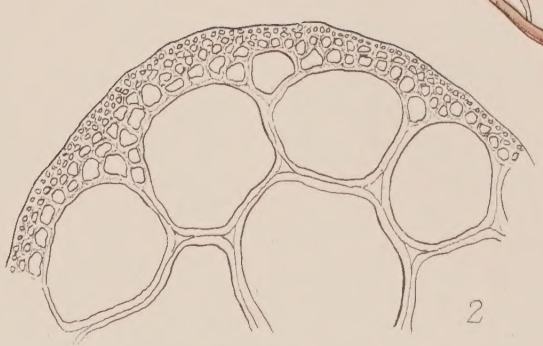
Per. Mat. Med., vol. ii, pt. 1, p. 9; Per. Mat. Med., by B. & R., p. 381; Pharmacographia, p. 679; U. S. Disp., by W. & B., p. 259; Melzar, in Proc. Amer. Pharm. Assoc. (1860), p. 165; Bates, in Pharm. Journ., ser. 2, vol. xi, p. 298; Blondeau, Journ. de Pharm., 2 (1865), p. 159; A. H. Church, in Proc. Amer. Pharm. Assoc., vol. xxv (1877), p. 177, from Arch. Ph., Jan., 1877, p. 61.

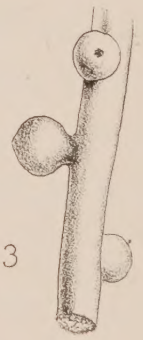
DESCRIPTION OF PLATE.

Drawn from a specimen sent by Mr. Roper from Eastbourne, Sussex, and from others in the British Museum; the fruit added from Kützing.

1. A plant.
2. Section through frond and part of a cystocarp.
3. Young spores attached to the filamentous network.
4. Ripe spores.
5, 6. Broad and narrow varieties.

(2–4 magnified.)





D.Blair F.L.S. ad sicc. del et lith.

M&N.Hanhart imp.

GRACILARIA LICHENOIDES, *Grev.*

N. Ord. ALGÆ.

Tribe *Florideæ*.

Genus **Gracilaria**,* *Grev.* Agardh., Sp. Alg., ii, p. 584. There are between 20 and 30 species, natives of the warmer seas of various parts of the world.

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306. Gracilaria lichenoides, *Greville, Algæ Britann., p.* 54, (1830).

Ceylon Moss.

Syn.—Fucus lichenoides, *Linn.* F. gelatinosus, *Koenig.* Sphærococcus lichenoides, *Agardh* non *Grev.* Plocaria candida, *Nees.*

Figures.—Turner, Fuci, t. 118, cop. in Pereira, Mat. Med., p. 14; Kützing, Tab. Phycolog., xviii, t. 81.

Description.—A thallophyte about 6—9 inches high, rising from a peltate base of attachment. Frond elongated, cylindrical, about $\frac{1}{8}$ inch in diameter at its thickest, gradually diminishing upwards, soft or subcartilaginous, smooth, purplish with a tinge of green when fresh, but becoming yellowish-white when dried, irregularly branched dichotomously and rather copiously, the branches rather fastigiate, bare below, but again divided above, with tapering branchlets, which are often forked at the apex with short divaricate segments. Fructification consisting of small, more or less spherical, slightly elongated bodies (*coccidia, cystocarps*), sessile, and irregularly scattered over the primary and secondary branches, bright red, open at the apex by a small orifice leading into the hollow interior, which contains the spores (*gemmidia*), supported on filaments, which proceed from a central placenta-like column.

Habitat.—This seaweed is found on the coasts of the Indian Ocean, especially in Ceylon, and ranges as far as Burmah, the Malay Archipelago, including Java, and probably also Australia. As generally seen, in a dry state, the whole plant is colourless or pale yellowish, and this is possibly the result of some bleaching process.

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* *Gracilaria*, from *gracilis*, slender, in allusion to the form.

The *Sphærococcus lichenoides* of Greville, figured in his 'Scottish Cryptogamic Flora,' t. 341, was found on the Devonshire coast. It is now referred to *G. compressa*, Ag., and differs from the true Eastern *S. lichenoides* in its more intense red colour.

A closely allied species, *G. confervoides*, Grev., is also employed, especially its variety *tenuis* (*Fucus edulis*, Gmel.), which is often referred to *G. lichenoides*. The reproductive organs of this species are beautifully figured in Thuret's 'Études Phycologiques,' t. 40. It is diœcious, the very numerous minute antheridia being immersed in the cortical part of the upper divisions of the frond of the male plant, and containing spherical fertilising corpuscles. The female plant possesses, besides the cystocarps, another form of fructification in tetraspores, which are immersed in the cortex of the frond.

Agardh., Sp. Alg., ii, p. 588; Kützing, Sp. Alg., p. 776; Flück. & Hanb., Pharmacogr., p. 681; Thuret, Études Phycologiques, p. 80.

Official Part and Names.—Gracilaria; the dried plant of Gracilaria lichenoides, and G. confervoides, *Greville* (I. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of the United States. It is commonly known under the names of *Ceylon Moss* and *Jaffna Moss;* and it constitutes the *Agar Agar Carang* of the Malays.

Collection and Commerce.—It is largely collected in the islands of the Indian Archipelago, where it is more especially used; and from whence it is also exported in large quantities to China. The Ceylon Moss of commerce is said to consist of the two species of *Gracilaria* which are official in the Pharmacopœia of India. It would also appear that under the name of *Agar agar* or *Ceylon Moss*, two very different articles have been imported into this country; thus, Archer has shown that specimens received at Liverpool consisted of *Gigartina spinosa* (*Fucus spinosus*), and contained no portion of either of the official plants. It seems clear, however, that, as a general rule, the principal constituent of Ceylon Moss is *Gracilaria lichenoides*.

General Characters and Composition.—The official characters are as follows:—"In yellowish-white or light purple ramifying

filaments, from one to several inches in length; at the base the largest fibres do not exceed the thickness of a crowquill, the smaller fibres being about as thick as fine sewing-thread; consistence cartilaginous, odour resembling seaweed, taste feebly saline." When moistened it becomes somewhat translucent, increases slightly in volume, and frequently exhibits small, whitish, globular or mammiform fruits or cystocarps.

The analysis of O'Shaugnessy yielded, in 100 parts of the drug, 54·5 of vegetable jelly, 15 of starch, 18 of cellulose, 4 of gum, and 7·5 of inorganic salts. The vegetable jelly is the *gelose* of Payen, and is sometimes regarded as identical with pectin. It is also said that the amount of this jelly varies in different specimens from 37 to 78 per cent.

Medical Properties and Uses.—In its properties it resembles carrageen, being emollient, demulcent, and nutritive. In the form of decoction or jelly, it may be used as a light and readily digestible article of food for invalids and children. As a medicinal agent it is useful in pulmonary complaints, and in cases characterised by irritation of the intestinal canal.

The official decoction of the Pharmacopœia of India may be taken *ad libitum;* and if milk be substituted for water in the above preparation, it is usually more grateful to the taste as well as more nourishing. It may be further improved by the addition of some aromatic. Jelly may also be prepared from this in a similar way to that directed for making carrageen jelly, and it may then be flavoured in a similar manner.

In China, and in the Indian Archipelago, it is largely used with some other algæ for making jellies and sweetmeats; and for stiffening purposes, varnishes, &c.

Per. Mat. Med., vol. ii, pt. 1, p. 13; Pharmacographia, p. 681; O'Shaugnessy, Bengal Dispensatory (1841), p. 668; Pharmacopœia of India, p. 260; Bentl., Man. Bot., p. 709; Archer, in Pharm. Jl., ser. 1, vol. xiii, pp. 313 & 447; Simmonds, in Pharm. Jl., ser. 1, vol. xiii, p. 355; Payen, in Pharm. Jl., vol. i, ser. 2, p. 470; M. C. Cooke, in Pharm. Jl., ser. 2, p. 504.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Museum of the Pharmaceutical Society, the details added after Kützing.

1. Portion of a plant.
2. Part of transverse section of the frond.
3. Portion of frond with cystocarps.
4. Section of a cystocarp of *G. compressa*.

(3, enlarged; 2, 4, much magnified.)

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